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EXPERIMENT STATION RECORD.

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From the viewpoint of agricultural education, the exercises at the Massachusetts Agricultural College in commemoration of the fiftieth anniversary of the graduation of its first class of students were among the outstanding events of the recent Commencement season. This college, though not the earliest in the field of higher education in agriculture in this country, has always been regarded as among the pioneers. Likewise, its unique position in the land-grant college group as the only institution established under the Morrill Act not charged with instruction in the mechanic arts has made its history and development of special interest. In a general way its problems, difficulties, and achievements may be regarded as typical of the American agricultural college as a distinctive institution. The completion of its first half century was therefore less a local than a national occasion, and the appropriate and impressive observance of it a matter of deep gratification and pride to every friend of agricultural education.

The success of the celebration must be attributed in no small degree to the well-conceived and thorough preparations which had preceded. The matter had been under advisement for some time, for the original intention had been to observe the fiftieth anniversary of the opening of the college to students by an elaborate celebration in the fall of 1917, and considerable had been accomplished when the entry of this country into the war caused the postponement of the enterprise. Upon the cessation of hostilities the project was revived and with some modifications carried out most successfully.

Under the plans adopted, a celebration was projected continuing over an entire academic year and culminating in special exercises at the 1921 Commencement. One distinctive feature of this "year of jubilee" was the cooperation of the college in a series of conferences on various phases of the development of agriculture and country life. This part of the program included meetings at or near the college of several national bodies, such as the American Country Life Association, the American Civic Association, the American Association of Agricultural College Editors, and the Association of Land Grant Colleges; a conference at the time of the dedication of the Women's Building on the relation of women to country life; the first student conference of the International Association for Agricultural Missions; and gatherings of a considerable number of State organizations. These meetings brought the work of the college prominently before a large number of people of varied interests from all over the country as perhaps no other agency could have done, and illustrated some of the broader opportunities for leadership open to this type of institution.

Another phase of the celebration was the preparation and issue under college auspices of a series of semicentennial publications, "dedicated to the men of the college who by wise and generous service have helped the institution to the position which it holds to-day." The first of these publications, completed some time ago, was a brief history of the institution during its first half century, and another a graphic account of the college during the late war. A third volume, still in preparation, is to comprise a bibliography of all publications of the faculty, alumni, and others connected with the institution. These volumes will serve to collect and preserve data of great value which without the stimulus of a specific occasion might have become hopelessly scattered. Their compilation was an inspiration for which the college is to be congratulated.

The climax of the celebration, however, was the five-day program at Commencement. Fostered by systematic advance efforts to bring back to the campus every available alumnus and friend of the college, and favored by nearly ideal weather conditions, Commencement week was above all a veritable home-coming. Over forty per cent of the living alumni were registered, many from far distant points and of classes long out of college, and the total attendance exceeded three thousand persons. This response was in itself most stimulating and encouraging.

The exercises opened on June 10, which had been designated Citizens' Day, and was devoted primarily to the relations of the college to the State and Nation. The Federal Government was represented on this program by the Secretary of Agriculture, the only participant in the entire celebration who had not been previously connected with the college in some capacity. The spokesmen for the State of Massachusetts were its Governor, who is also ex-officio president of the board of trustees, and the State Commissioner of Agriculture.

The address of Secretary Wallace took up, first of all, the significance of the initial fifty years in the life of an institution, as the period when "the ground is cleared, the foundations are laid, the superstructures are built, traditions are formed, experience is accumulated, and the guiding spirit, the soul, of the institution, is created." This anniversary, he went on to say, could well be regarded by friends of the Massachusetts Agricultural College with feelings of deep satisfaction, for the college "has had a most worthy part in one of the greatest periods of history. It has had its full share in the development of a system of agricultural education which is the admiration of the world. On its staff have been many of the most eminent educators of their time. An astonishingly large percentage of its men have had a prominent part in the agricultural development of the Nation, and have thus multiplied many times the work which has been done here."

Secretary Wallace went on to discuss the revolutionary changes in the agricultural situation during the past half century, notably the remarkable increase in food production. This increase he attributed in part to the addition of vast areas to our cultivated land, but "much of it was due to the scientific research and inventive genius of the thousands of young men who got their inspiration and training in this and like colleges. For it is during this period that we have seen the development of agricultural science. The National Department of Agriculture was created; the State experiment stations were established; the extension system of carrying the teachings of the colleges and the discoveries of the scientists to the men on the farms was developed."

Some of the new and complex agricultural problems of the present reconstruction period were then recounted, and as a means of helping to solve them increased attention by the agricultural colleges to economic questions was strongly advocated. "Looking back, we can see now that if our agricultural colleges have failed to measure up to their greatest opportunities of service that failure is due to confining practically all of their effort to the promotion of greater production and giving so little attention to the no less important matter of agricultural economics. The farmer needs all of the training in production that the colleges can give him, but the most urgent need now is the development of an entirely new realm of organized knowledge of the economic factors which will enable him to cheapen his production and improve his distribution.

"As we plan for the future it seems clear to me that, without abating in any way our efforts in the field of scientific research, without slacking in our search for better and cheaper methods of production, it is the clear duty of the agricultural colleges of the country to give more and more attention to study and instruction in the field of agricultural economics. The mission of our agricultural colleges is not to promote agriculture at the expense of industry of commerce, nor to give the farmer the sort of an education that will place him in a position of unfair advantage over other classes, but rather, through more scientific methods of production and less wasteful methods of distribution, enable him to better serve the Nation."

The responsibilities of the agricultural colleges toward the food supply were also brought out by Governor Cox, who as the representative of a State primarily industrial in its interests, declared that "at a late date we are coming to see that our industrial and commercial progress depends in large measure upon the development of our agricultural resources. . . . It is encouraging in the highest degree that in Massachusetts we have at last recognized the absolute necessity of promoting our agricultural welfare, and that men of vision are joining hands with practical farmers in finding the solution of the vital needs of the Commonwealth." In this connection, he warmly commended the work of the college and advocated its further development, saying that "we must look more and more to an institution of this sort for leadership in the solution of all the problems which have a bearing on the life in rural communities."

The address of Commissioner Gilbert, a graduate of the class of 1904, was entitled What Massachusetts and its Agricultural College have done for the Agriculture of the Country. Among the specific contributions he cited the pioneer work of the early settlers, the invention of the cotton gin and the development of such valuable fruits as the Baldwin apple and Concord grape by citizens of the State, the educational influence of the Massachusetts Society for Promoting Agriculture, organized in 1792, and the State Board of Agriculture, established in 1851, and in particular the work of the college and its alumni. Dr. Gilbert presented statistics showing that more than two-thirds of the 1,700 graduates are in agricultural pursuits, 28 per cent being farm operators. Especially noteworthy was the finding that 21 per cent of this large number are in "positions of recognized leadership such as agricultural college administrators and teachers, experiment station and extension leaders, officials of the United States Department of Agriculture, and the like," thus corroborating the remarks of Secretary Wallace quoted above.

Following Citizens' Day came in turn Alumni Day, largely occupied with various alumni gatherings and related activities; Dedication Day, at which time Memorial Hall was formally transferred by the building committee of the alumni to the college; Anniversary Day, the distinctive feature of which was a mass meeting for reminiscence into the past and forecast into the future; and finally the closing exercises of Commencement Day. Throughout these meetings the historical aspect of the occasion was emphasized in many ways.

Various circumstances necessitated the postponement of the elaborate pageant depicting important chapters in the college history which had been originally contemplated, but an anniversary play composed by a member of the faculty was creditably presented by the Roister Doisters, the undergraduate dramatic society. This play, based on college happenings in 1871, introduced personifications of the famous "Faculty of Four" (Clark, Stockbridge, Goessmann, and Goodell), and served to bring out quite picturesquely the background of the early days.

Further opportunity for retrospect and reminiscence was afforded in the enthusiastic mass meeting on Anniversary Day. Here the developments of fifty years in educational lines, various forms of student activities, and other directions were recounted, with a closing address by President Butterfield on The College of the Future. Significant of the progress during the half century were statistics showing an increase in number of buildings from 13 to 50, of land from 383 to 1,480 acres, of property valuation from $225,000 to $1,800,000, of annual income from $75,000 to $1,000.000, of professional staff from 10 to 140, and of students in residence from 139 to 950.

The exercises of Commencement Day were likewise of historical flavor, with the pioneer class of 1871 as guests of honor. Eight of the thirteen living graduates were present, and upon each of these an anniversary parchment setting forth the felicitations of the college was bestowed. Sharing their laurels were the 95 members of the class of 1921, as well as three recipients of the degree of Master of Science and one of that of Doctor of Philosophy.

The most impressive and in many ways the most significant service of the semicentennial was the dedication of Memorial Hall. This is a beautiful structure, built by the alumni as a student and alumni activities building in memory of the fifty-one men connected with the college who gave their lives to their country in military service during the war. Constructed at a cost of over $150,000, raised entirely by small contributions from about one thousand five hundred alumni, students, and faculty, and a few friends, this building symbolizes the patriotism and self-sacrifice embodied in the enrollment of over one thousand three hundred M. A. C. men in military or naval service during the war. Conceived soon after the cessation of hostilities, it is believed to be the first college memorial building to be completed, and constitutes a concrete fulfillment of the pledge carved upon its walls: "We will keep faith with you who lie asleep."

Very naturally, the various meetings of the celebration afforded many opportunities to discuss anew the function of an agricultural college and the lines of development which it should pursue in the future. The unique status of the Massachusetts College in the past was referred to by the Governor, the State Commissioner of Education, and various alumni, and in several addresses by President Butterfield. As defined by Commissioner of Education Payson Smith, the institution is established and maintained by the State for "the second of the great general purposes of education, which is that of releasing for the service of the people of the State the stores of knowledge that relate to the field of agriculture, and of course in the field of experimentation for making new discoveries in the field of science and their practical application to the needs of an important basic industry." Likewise, President Butterfield pointed out that historically "from the very outset its work was limited to the field of agriculture broadly defined. Science applied to the art of agriculture became the basis for the work of the college. A thorough-going education was contemplated, but agriculture was regarded as the one real object from the beginning, and the idea has always been adhered to, although many graduates have gone into other work."

Looking toward possible developments of the future, he expressed the hope that this status would be adhered to. "However, we have rightfully and widely broadened the definition of agriculture to include not merely the production of plants and animals, but their distribution, conservation, and ultimate use. We are a food supply college." This conception of a "food supply college," an "instrument of education intended to help solve the whole problem of food supply" he maintained would mean a vast enlargement of investigational and extensional activities and the training of men for many new occupations.

Speaking from the broader standpoint of the land-grant colleges of the United States, President W. E. Stone of Purdue University, a graduate of the class of 1882, defined the function of these institutions as "continuously to interpret and correlate the progress of science with the basic industries by training the men who shall serve the industrial world as its leaders, operators, investigators, and teachers. . . . In their student bodies composed of young men and women largely from the middle classes and imbued with the American traits of energy and industry; in their curriculum touching the scientific foundations of industry, transportation, and communication; in their research departments occupied with the solution of concrete, practical problems of the farm and agriculture; in their extension service carrying helpful knowledge and advice to the farm, the factory, and the home; in their provision for elementary military training for national defense; in their latest developments touching social and economic conditions in rural life; in their close cooperation with all forward looking movements and agencies to improve the Nation's fundamental industries, these colleges are in the highest degree service institutions, educational at the foundation, but extending their services and reaching the life and welfare of the people in a thousand concrete ways."

An occasion such as this with its review of history, its retrospect of difficulties encountered and overcome, its survey of what has been accomplished, and especially its forecast of a future of higher ideals and greater usefulness, has large significance and helpfulness to an institution, and scarcely less so to the group of institutions of which it is a part. In carrying out so sucessfully its worthy and dignified semicentennial celebration, the Massachusetts Agricultural College has rendered a real service to the land-grant colleges of the Nation, for as President Stone pointed out, "the half century of vicissitude, of effort, and of achievement which Massachusetts Agricultural College celebrates has in some degree been experienced by all of her sister institutions." The recognition, the appreciation, and the inspiration which it received through its anniversary observance can not fail to be stimulating and helpful to the cause of agricultural education as a whole.

Another 1921 Commencement program warranting special mention was that of the University of Tennessee from June 5 to 8. The exercises held at this institution centered around the dedication of two imposing buildings, just completed as the beginning of a comprehensive building project. The distinctive feature of the program was a series of State conferences of various groups on the promotion of efficient citizenship.

The two new buildings constitute notable additions to the university equipment. Ayres Hall, the larger structure, is to be used primarily as a liberal arts building, and architecturally is the dominant structure on the campus. Named in honor of former President Brown Ayres, well known among American educators through his long service to the institution. it will provide class rooms and other accommodations for nearly two thousand students, including facilities for the College of Agriculture in the basic sciences and humanities. Eventually, the hope is to supplement it with an administration building and a large auditorium, the latter to be given by the alumni association as a war memorial.

The second building, to be known for the present simply as the agricultural building, is likewise a large and modern structure, occupying a commanding location on the university farm. It will house the administrative officers of the College of Agriculture, the station, and the extension division, together with laboratories, lecture rooms, and offices for the departments of horticulture, agronomy, animal husbandry, veterinary science, dairying, botany, and agricultural economics. This building will serve as the nucleus of a projected agricultural group.

The dedicatory exercises for these two handsome structures were well attended and impressive. The principal speakers were for Ayres Hall, Hon. P. P. Claxton, formerly United States Commissioner of Education, and for the agricultural building, President W. O. Thompson, of Ohio State University. The speech of Dr. Claxton dealt with the relations of the university and the State, while that of President Thompson discussed the achievements and functions of the land-grant colleges of the country.

The conferences on citizenship were held in the new agricultural building and attracted an attendance of several hundred persons. The plan of organization was in ten groups, including agriculture, commerce and industry, finance, civil administration, law, medicine and dentistry, the press, the home and social welfare, church educational work, and education. These groups discussed in detail the need and scope of a citizenship program for the State and ways in which the university could assist in such a program. Marked interest is reported to have been taken by the remaining groups in the results already accomplished along research and extension lines in agriculture, and endorsement was given to similar undertakings in other directions. Strong support to the university program was pledged and a permanent organization effected to aid its cause.

The representative and influential attendance at these conferences showed in a very gratifying way how fully the State as a whole is interested in this institution. It was clearly brought out that the establishment of experiment stations in Middle and West Tennessee and the extension work in agriculture and home economics had been very important factors in bringing about this State-wide support of the university, which makes its future so promising.

As in the Massachusetts celebration, the Tennessee Commencement attracted wide attention. The Governor and other high officials of the State were represented and wide publicity was given the exercises, demonstrating anew how completely in North and South alike the land-grant colleges have become accepted and honored members in our educational system.

RECENT WORK IN AGRICULTURAL SCIENCE.

AGRICULTURAL CHEMISTRY—AGROTECHNY.

The globulin of the cohune nut, Attalea cohune, C. O. JOHNS and C. E. F. GERSDORFF (*Jour. Biol. Chem., 45 (1920), No. 1, pp. 57–67, pl. 1*).—The authors at the Bureau of Chemistry, U. S. Department of Agriculture, have analyzed the globulin of the cohune palm nut, which is now being utilized in British Honduras for its oil. The press cake obtained by cold expression of the oil was found to contain 20.63 per cent of protein. By dialysis of a saline extract of the press cake or by precipitation with ammonium sulphate, a globulin was obtained quite similar to that obtained from the coconut as shown by its elementary analysis and by its amino nitrogen distribution, which was as follows: Amid N 7.5 per cent, humin N adsorbed by lime 0.84, humin N in amyl alcohol extract 0.11, cystin N 0.53. arginin N 30.87, histidin N 2.61, lysin N 7.94, amino N of filtrate 47.87, and nonamino N of filtrate 2.28 per cent. The distribution of the basic amino acids was cystin 0.81 per cent, arginin 17.17, histidin 1.72, and lysin 7.42 per cent. A trace of albumin was obtained, the albumin coagulating between 60 and 68° C. and the globulin coagulating near the boiling point of water.

The authors conclude that the cohune nut press cake will be suitable for use in feeds.

Review of the literature on ethereal oils and perfumes published during 1914–1918, G. PELLINI (*Gior. Chim. Indus., 1 (1919), Nos. 3, pp. 119–126; 4, pp. 178–188*).—This is a compilation from the literature of data on the analytical constants of various ethereal oils and perfumes, together with statistics on the importation and exportation of these oils in Italy during the years covered.

The fermentation of xylose by bacteria of the aerogenes, paratyphoid B, and typhoid groups, E. B. FRED and W. H. PETERSON (*Jour. Infect. Diseases, 27 (1920), No. 6, pp. 539–549*).—Following the methods used in previous studies of the fermentation of xylose and other carbohydrates by pentose-fermenting bacteria (E. S. R., 44, p. 610), a study was made of the products of the fermentation of xylose by bacteria of the aerogenes-typhoid group including culture 26, *Bacillus lactis aerogenes*, *B. typhosus*, and *B. paratyphosus* B.

Xylose was readily fermented by the organisms of the aerogenes and the paratyphoid groups with the rapid evolution of gas. The products of fermentation with *B. lactis aerogenes* were carbon dioxid, hydrogen, and alcohol, with small amounts of volatile acids; with *B. paratyphosus* B, formic, acetic, butyric, lactic, and succinic acids, ethyl alcohol, carbon dioxid, and hydrogen. About 75 per cent of the sugar was consumed in the former and about 92 per cent in the latter case. The fermentation of xylose by the typhoid bacteria was very incomplete, not more than one-fourth of the xylose being decomposed. No gaseous products were formed except small amounts of carbon dioxid. The chief products of the fermentation were formic, acetic, butyric, and succinic acids, the latter in the largest amounts.

Contribution to the study of the enzym indices of the blood.—Determination of catalase, peroxidase, and esterase in a drop of blood, A. BACH and S. ZOUBKOFF (*Compt. Rend. Acad. Sci.* [*Paris*], *171* (*1920*), *No. 20, pp. 967–969*).—Methods are described for determining catalase, peroxidase, and esterase in minute quantities of blood, one drop of blood dissolved in 20 cc. of water being sufficient for the three determinations.

The average, maximum, and minimum values for catalase in 40 observations on blood obtained from a single subject in a period of three months were, respectively, 17.8, 18.78, and 17.17 mg. of H_2O_2 decomposed by 0.001 cc. of blood. Corresponding results for oxidase were 0.121, 0.153, and 0.096 mg. of guaiacol oxidized, and for esterase 0.131, 0.147, and 0.108 mg. of guaiacol set free and oxidized.

The distribution of inorganic iron in plant and animal tissues, H. W. JONES (*Biochem. Jour.*, *14* (*1920*), *No. 5, pp. 654–659*).—Various plant and animal tissues were examined for inorganic iron by staining with a solution of hematoxylin in distilled water, under which conditions a deep bluish-black color is obtained with ordinary inorganic iron and a brown color with colloidal iron.

Inorganic iron was found to be quite widely distributed throughout vegetable and animal tissues. The lower plants and animals gave the reaction more strongly than the higher ones, and plant tissues as a whole more strongly than animal. In the tissues of guinea pigs the staining was more marked in the cells which immediately surround the blood vessels. Fetal tissues showed a more marked reaction than adult tissues, and placental tissues definite staining in patches in the chorionic villi and in most of the nuclei. In human blood smears sufficient evidence was not obtained to indicate the presence of inorganic iron.

The thermal death point in relation to time of typical thermophilic organisms, W. D. BIGELOW and J. R. ESTY (*Jour. Infect. Diseases*, *27* (*1920*), *No. 6, pp. 602–617, figs. 4*).—Attention is called to the importance, especially in the sterilization of canned foods, of knowing the conditions affecting and the time necessary for complete destruction of resistant spores at high temperatures. A method is described which is said to give accurate results for the determination of the thermal death point of heat resistant spores, and data are reported showing not only the effect of different temperatures on the time necessary to destroy a definite suspension of spores of certain typical thermophilic bacteria, but also the influence of different concentrations of the same spores in media of the same and varying H-ion concentration.

The method involves the use of the De Khotinsky electric bath with thermoregulator attachment for maintaining uniform temperatures and of special soft glass culture tubes 7 mm. (inside diameter) by 250 mm. long and with 1 mm. thickness of wall. These tubes which, after inoculation with 1 cc. of the suspension of spores prepared according to a standardized technique, are sealed off to within 2 in. of the surface of the liquid, can stand a sudden change of temperature over a wide range and reach the temperature of the surrounding medium in a few seconds. The technique of their use in the experiments reported is described in detail. From the results obtained, which are presented in tables and charts, the following general conclusions are drawn:

"The time necessary to destroy a known suspension of spores in a medium of known H-ion concentration decreases as the temperature increases.

"The H-ion concentration influences the time necessary to destroy a known suspension of spores at a given temperature. As the pH value is increased, the time required for complete destruction is decreased.

"The initial concentration of spores per cubic centimeter affects the time necessary to sterilize a medium of known H-ion concentration at a given temperature. The larger the number of spores present in a medium, the longer the time necessary to destroy them."

Preparation of collodion sacs for use in bacteriology, F. L. Gates (*Jour. Expt. Med., 33 (1921), No. 1, pp. 25–43, figs. 7*).—A standardized method is described in detail for the preparation of collodion sacs suitable for intraperitoneal incubation and for other bacteriological experiments. These sacs are said to be "permeable to gases in solution, to inorganic salts, to dextrose, to certain protein-split products which are nutritive to bacteria, and to certain toxic products of bacterial metabolism, but they hold back antibodies, unsplit proteins, and formed elements such as bacteria and body cells."

A mechanical measuring instrument for sterile liquids, F. L. Gates (*Jour. Expt. Med., 33 (1921), No. 1, pp. 45–49, figs. 4*).—In the instrument described, which was first devised as a substitute for the graduated pipette in immunological tests, the principle involved is the displacement of the required amount of liquid by an equal volume of air at atmospheric pressure. The air is measured by a graduated syringe set to deliver any amount within its capacity. Before coming in contact with the liquid the air is twice filtered through cotton plugs, thus eliminating contamination.

The determination of hydrogen ions, W. M. Clark (*Baltimore: Williams & Wilkins Co., 1920, pp. 317, pls. 2, figs. 37*).—This volume consists of a detailed exposition of the two methods in common use for the determination of H-ion concentration, viz, the electrometric method involving the use of the hydrogen electrode, and the colorimetric method utilizing the color standards of Clark and Lubs, Sørensen, and others. Each of these methods is discussed from the standpoint of theory and practice, concise directions being given for the application of the method in all its details. In the section on the colorimetric procedure a color chart by M. Broedel, reproducing the colors of Clark and Lubs' indicators in solutions of known pH, is given. The chapters on the hydrogen electrode method, to which of necessity considerable more space is given than to the colorimetric method, are abundantly illustrated with diagrams of various types of hydrogen electrode apparatus and potentiometers.

Chapters are also included on the standardization of pH measurements and on supplementary methods of determining H-ion concentration, and, for the benefit of those to whom the subject is new, a final chapter is devoted to a running summary of some of the principal applications of H-ion concentration determinations. This is written in the form of an index to the extensive bibliography which follows. Necessary tables for use in H-ion concentration determinations are assembled in an appendix.

A volumetric determination of potassium and its application to the analysis of fertilizers, G. Ajon (*Gior. Chim. Indus. ed Appl., 2 (1920), No. 8, pp. 422–426*).—A volumetric method of determining potassium in commercial chlorids and sulphates is described which depends upon the precipitation of the potassium as sodium potassium tartrate by tartaric acid and sodium hydroxid in the presence of alcohol, the excess of the reagents being titrated with N/10 NaOH in 96 per cent alcohol, using phenolphthalein as an indicator.

Gasometric determination of nitrogen and its application to the estimation of the nonprotein nitrogen of blood, R. L. Stehle (*Jour. Biol. Chem., 45 (1920), No. 1, pp. 223–228*).—The author suggests the use of the Van Slyke apparatus for the determination of CO_2 of blood plasma (E. S. R., 37, p. 804) for gasometric nitrogen determinations of urea, etc., with the use of hypobromite. The procedure is as follows:

The sample is digested with as small an amount of concentrated H_2SO_4 as possible and a small crystal of $CuSO_4$, and after cooling is diluted and made up to 100 cc. or some definite volume. A definite quantity, preferably 10 cc., is placed in the Van Slyke apparatus, and the dissolved air is expelled by reducing the pressure. Sufficient alkali is then added to neutralize the H_2SO_4, followed by 2 cc. of the standard hypobromite solution. The pressure is reduced and the apparatus shaken for about a minute to completely liberate the nitrogen. To prevent liberation of oxygen from a possible excess of hypobromite, a small amount of sodium pyrogallate solution is run into the reaction chamber as soon as the decomposition of the ammonium salt is over. The volume of nitrogen is best read by making the volume of the gas exactly 1 cc. and measuring the pressure necessary to accomplish this. Corrections should be made for the nitrogen content of the hypobromite solution and, if great accuracy is required, for the quantity of nitrogen dissolved in the final solution.

Comparative results obtained by the above method and the Kjeldahl procedure in nitrogen determinations with sodium sulfanilate, casein, uric acid, dried milk, and urea are reported. While not having the accuracy of the Kjeldahl method, the new procedure is considered to give results of ample accuracy for many purposes and to have the advantage of being much more rapid.

Directions are also given for the application of the method to the determination of the nonprotein nitrogen of blood, using the tungstic acid precipitation method of Folin and Wu for obtaining a protein-free blood filtrate.

Determination of glucose and starch by the alkaline potassium permanganate method, F. A. Quisumbing (*Philippine Jour. Sci., 16 (1920), No. 6, pp. 581–599, figs. 6*).—The author reports a study of the conditions essential to the accurate estimation of glucose and starch by the alkaline potassium permanganate method, and describes a technique by means of which results have been obtained which are said to be of an accuracy equal to that of volumetric Fehling determinations. The standardized procedure for the determination of glucose is as follows:

Fifty cc. of N/10 potassium permanganate solution, 25 cc. of a solution of sodium carbonate containing 8.48 gm. of anhydrous sodium carbonate per liter, and 25 cc. of the glucose solution (which should not contain more than 40 gm. of glucose) are placed in an Erlenmeyer flask, which is then placed on a special heating device so regulated that the temperature is raised from 29 to 95° C. in 2 minutes. The flask is heated for exactly 2 minutes after the temperature has reached 95°, after which it is removed, 25 cc. of 28 per cent H_2SO_4 and 25 cc. of N/10 oxalic acid solution are added, and the excess oxalic acid is titrated against N/10 potassium permanganate until the liquid assumes a pink color which remains for a few seconds. The calculations are made from a table of standards of glucose and starch.

In applying the method to starch analysis the washed sample is first hydrolyzed with sulphuric acid. When flour is to be analyzed it should be hydrolyzed by the saliva or diastase method, as the results by the permanganate method are about 10 per cent higher after acid hydrolysis of the flour.

A volumetric method for the determination of lactose by alkaline potassium permanganate, F. T. Adriano (*Philippine Jour. Sci., 17 (1920), No. 2, pp. 213–220*).—The method noted above has been applied to the determination of lactose in milk with the use of lactose permanganate tables similar to those for glucose and starch. Comparative results are reported of lactose determinations with the permanganate method and the optical and Soxhlet methods on samples of diluted evaporated milk, fresh and sterilized cow's milk, and a synthetic milk prepared in the laboratory by mixing the necessary proportions of water, butter, casein, pure lactose, ash, and water.

The percentages of lactose given by the optical method were consistently lower than by either of the other methods, and the Quisumbing method gave slightly lower results than the Soxhlet. The differences between the polariscope, and the two oxidation methods were greater in the case of the sterilized evaporated milk than in that of fresh or sterilized cow's milk. This is thought to be due in part at least to chemical changes affecting polarization occurring in the milk during the process of evaporation.

The author concludes that the results obtained by the polariscope method are unreliable, particularly in the analysis of canned milk. Where a high degree of accuracy is required either the Quisumbing or the Soxhlet method should be given preference, the former being the more rapid of the two.

Lactose—Determination of in milk by colorimetric method, R. G. Owen and R. Gregg (*Jour. Lab. and Clin. Med., 6 (1921), No. 4, pp. 220, 221*).—The method described is an adaptation to lactose of Folin's latest method of determining blood sugar (E. S. R., 42, p. 712). The technique is as follows:

To 1 cc. of milk in a 100 cc. flask is added 2 cc. of 10 per cent sodium tungstate and, drop by drop, 2 cc. of 2 N/3 H_2SO_4. After standing for 5 minutes the mixture is diluted to 100 cc. and filtered. One cc. of the filtrate and 1 cc. of water are placed in a Folin special sugar tube, and to this tube and two others containing as standards 2 cc. of a solution containing, respectively, 0.5 gm. and 0.7 gm. of pure lactose are added 2 cc. each of alkaline copper solution. After standing in boiling water for 6 minutes the tubes are placed in cold water until cooled. Two cc. of the Folin molybdate phosphate solution is then added to each tube, and after standing a few minutes the three solutions are diluted to 25 cc. and compared in the colorimeter. It is said that the figures obtained with the above method agree closely with those of the Folin titration method.

Rapid method for the determination of fat in flour, bread, etc., E. Vautier (*Mitt. Lebensmtl. Untersuch. u. Hyg., Schweiz. Gsndhtsamt., 10 (1919), No. 1, pp. 40–44*).—For the rapid determination of fat in cereal products, the author suggests heating for 5 minutes at boiling temperature 1 gm. of the thoroughly dried and powdered sample with HCl, 1:1, in special centrifuge tubes, adding a mixture of equal parts of petroleum ether and ether, shaking for 5 minutes, centrifuging for 10 minutes, and finally decanting an aliquot of the clear liquid, evaporating the solvent and weighing the residue.

Studies on the determination of the egg content of food materials by means of the precipitin reaction, J. Thöni (*Mitt. Lebensmtl. Untersuch. u. Hyg., Schweiz. Gsndhtsamt., 10 (1919), No. 1, pp. 1–26, figs. 4*).—A study of the accuracy of the precipitin reaction with egg white and egg yolk in the fresh and dried state is reported, which shows that the method can be used for the quantitative determination of both in the fresh state, but that in dry and old products it is suitable only for egg white preparations. The technique of the method as applied to the determination of the latter is described in detail.

Examination of meat and meat products, P. A. van Driest (*Tijdschr. Diergeneesk., 47 (1920), Nos. 1, pp. 8–19; 2, pp. 37–51*).—Following a brief review of the literature on methods of detecting spoilage in meat and meat products, tables are given of the results obtained in the examination of sausages, cured meats, etc., by the determinations of acidity, ammonia, and amino acids, the latter by the formol titration method of Sørensen. While sound products gave varying results for these determinations, the formol and ammonia numbers were much higher in the spoiled than in the sound products.

The detection of coumarin in vanillin, L. Gerey (*Mitt. Lebensmtl. Untersuch. u. Hyg., Schweiz. Gsndhtsamt., 11 (1920), No. 2–3, pp. 69–71*).—The author suggests the use of a solution of iodin in potassium iodid (1 per cent iodin and 2 per cent potassium iodid) to detect the presence of coumarin in vanillin. With a saturated water solution of vanillin this reagent gives only the natural yellow color, but with a saturated solution of coumarin dark blue iridescent crystals resembling free iodin are formed. Modifications of the test to be used with solids or saturated solutions are described.

The salt or sodium chlorid content of feeds, G. S. Fraps and S. Lomanitz (*Texas Sta. Bul. 271 (1920), pp. 5–14*).—This publication includes a description of a rapid method for determining chlorids in feeds and the results of a study of the chlorid content of materials used in mixed feeds. The technique of the method is as follows:

Weigh 5.85 gm. of the feed into a 200 cc. volumetric flask, make up to volume with water, and let stand for an hour, shaking the flask 3 or 4 times during this interval. Pour off 70 to 80 cc. into a dry Erlenmeyer flask and add 1 gm. of carbon black or of dry lead acetate, giving the flask a rotary motion to mix the contents. After letting the flask stand for an hour with occasional stirring, filter the contents through a dry 11-cm. filter into a dry 6-oz. bottle, rejecting the first few cubic centimeters of the filtrate. Pipette 5 cc. of the filtrate into a beaker, make slightly acid with dilute nitric acid, and add from a burette with thorough stirring an excess (usually 5 cc.) of N/10 silver nitrate solution followed by 5 cc. of a saturated solution of ferric alum, and 10 cc. of nitric acid prepared by boiling a mixture of 1 part water to 3 parts concentrated HNO_3 until colorless. Finally titrate the excess silver nitrate with N/10 thiocyanate solution, the end point being marked by the appearance of a light brown to reddish color through the beaker. Tests of the method by checking the recovery of known amounts of NaCl added to feeds, by comparing filtering off the silver chlorid as recommended in the Volhard procedure with nonfiltering, and by comparing the method with the Official method of ignition with Na_2CO_3 on the same feeds, are reported, the results of which show that the short method is satisfactory from an analytical standpoint.

For the purpose of detecting added salt in feeds determinations by the Official method were made and are reported of the chlorids calculated as NaCl in a large number of simple and mixed feeds. The salt content of individual feeds was low in all except molasses, alfalfa, and packing house products, the molasses and alfalfa feeds containing about 1 per cent salt. It is thought that the added salt of a mixed feed may be approximately estimated by subtracting 1 per cent of the alfalfa and molasses present from the chlorids calculated as NaCl or by comparing the chlorid content with the average salt content of the ingredients.

Determination of coagulable protein in serum, W. N. Berg (*Jour. Lab. and Clin. Med., 6 (1921), No. 4, pp. 223–226*).—The author, in the Bureau of Animal Industry, U. S. Department of Agriculture, has devised a technique for the determination of coagulable protein in small amounts of dilute serum by direct precipitation with N/50 acetic acid.

The method calls for the use of specially made 1 cc. pipettes 250 mm. long and graduated into 0.01 cc., heavy glass centrifuge tubes of a maximum capacity of 13.15 cc. and a medium sized motor-driven centrifuge which is run at 2,400 revolutions per minute for 20 to 25 minutes during a determination. Into each of three clean weighed tubes is pipetted 0.5 cc. of serum, which is then diluted with 9 cc. of distilled water measured from a burette. The tubes are heated until hot to the hand, and the N/50 acid is gradually added to neutralize the alkalinity of the serum. When the precipitate formed as the acid is added no longer dissolves on rotating the tube, the tube is heated almost to a boiling temperature and allowed to stand a few minutes, after which it is centrifuged, the supernatant liquid is poured off, and the tubes are drained well, cleaned on the outside, and dried to constant weight in a vacuum desiccator.

In the series of 9 determinations of total solids and ash in the precipitates obtained from tetanus antitoxin, plasma, and serum, the coagulable protein thus precipitated amounted to an average of 91.4 per cent of the solids-not-ash

Determination of chlorids in blood, A. S. WETMORE (*Jour. Biol. Chem., 45 (1920), No. 1, pp. 113–118*).—The method proposed, which can be used with either whole blood or blood plasma, is based on the precipitation of protein by copper hydroxid and of the oxalate and part, if not all, of the phosphate by an excess of calcium hydroxid, and on the titration of the chlorids by the procedure of Rappleye (E. S. R., 39, p. 807). The technique of the procedure is described, and the results are reported of a comparison of this method with the Van Slyke-Donleavy (E. S. R., 40, p. 714) and other methods.

A method for the estimation of lactic acid in blood, G. A. HARROP, JR. (*Soc. Expt. Biol. and Med. Proc., 17 (1920), No. 7, pp. 162, 163*).—The method described is based upon the conversion of lactic acid into acetaldehyde in the presence of concentrated H_2SO_4, and the development of a color reaction with guaicol which can be estimated by comparison with standards in Nessler tubes or in a Duboscq colorimeter.

The adsorbent power of Norit compared with that of blood charcoal, H. R. KRUYT and C. F. VAN DUIN (*Rec. Trav. Chim. Pays-Bas, 4. ser., 39 (1920), No. 9, pp. 679–684, fig. 1*).—To determine the comparative adsorptive powers of Norit and blood charcoal, the isotherms of adsorption for the two substances were determined with combinations of ions of very different character, including the OH-ion of NaOH, the H-ion of HCl, phenol, and the sodium salt of *p*-sulfocinnamic acid, as representatives, respectively, of easily adsorbed organic and inorganic ions. Blood charcoal purified with acid was found to have a stronger adsorbent power for all these ions than either commercial Norit or Norit purified by boiling with dilute HCl and with water.

Commercial utilization of waste seed from the tomato pulping industry, J. H. SHRADER and F. RABAK (*U. S. Dept. Agr. Bul. 927 (1921), pp. 29, figs. 11*).—This supplements Bulletin 632 (E. S. R., 38, p. 807) by describing in detail the commercial methods involved in the handling of the material from the time the wet waste leaves the pulping machine until the finished product is ready for the market. The two important steps in preparing tomato seed for oil production, namely, the separation of the seed from the wet waste material and the drying of the seed, and the pressure and solvent methods for extracting the oil from the seeds are described in detail with illustrations and diagrams of the machinery employed.

Estimates on the cost of separating, assembling, drying, and crushing the seed, together with the cost of the necessary equipment, are reported. These indicate considerable profit provided the seed is separated and dried at the various pulping stations and shipped to central points where the oil, cake, and meal can be manufactured.

"The utilization of an agricultural waste of this character for the production of commodities of much commercial value is suggested as a conservation measure worthy of careful consideration."

Manufacture of ethyl alcohol from wood waste, E. C. SHERRARD (*Chem. Age [New York], 29 (1921), No. 2, pp. 76–79*).—This contribution from the U. S. Forest Products Laboratory, Madison, Wis., consists of a brief description of the process, plant requirements, and cost of the manufacture of ethyl alcohol from wood waste by hydrolysis with dilute acid under pressure.

METEOROLOGY.

Temperature variations in the United States and elsewhere, A. J. HENRY (*U. S. Mo. Weather Rev., 49 (1921), No. 2, pp. 62–70, figs. 3*).—This article is based on a study of the 12-month consecutive or overlapping monthly means of temperature for the New England States, Minnesota, Colorado, Washington, and Louisiana. In order to get beyond the influence of the secondary circulation due to cyclones and anticyclones the study was extended to include certain tropical stations, namely, Batavia, Habana, Honolulu, and Arequipa.

It was found that there is practically a continuous oscilltion of temperature up and down of varying magnitude and duration, and that these oscillations are often concurrent over large areas of the earth's surface, although they may or may not be in the same sense. The oscillations generally appear to occur and recur without order or in any systematic way. The preponderance of evidence points to a period of about 40 months, or one-third of a sunspot cycle, as being the one most commonly experienced.

There appears to be "a lack of synchronism in the variations in sunspots and terrestrial temperatures, which suggests that the two events may not stand in the relation of cause and effect, but that both events may be due to a common, at present unknown, cause. The temperature variations in the United States east of the Rocky Mountains and above north latitude 40° are so directly controlled by the secondary circulation as to render futile any attempt to forecast the character of the season in advance. On the Pacific coast and in the zone south of north latitude 40° the outlook is more hopeful. The amplitude of the variations in terrestrial temperature that may be due to sunspots is small, less than 1° C. on the average in the Tropics and diminishing thence toward the poles. In the United States the range from the year of highest temperature at sunspot minimum, 1900, to the year of lowest temperature in a year of spot maximum, 1917, amounted to 2.5° F. (1.4° C.)."

Sequence of winters in the northeastern United States, C. F. Brooks (*U. S. Mo. Weather Rev., 49 (1921), No. 2, pp. 71–74, fig. 1*).—"A study of the sequence of mean winter temperatures since 1812 in the northeastern United States shows apparently no other than a chance relationship four-fifths of the time. The other fifth includes two remarkable series of alternating cold and warm winters, with almost identical preliminaries of a few moderately mild winters, an ordinary or moderately cold winter, and then a severe winter, which opens the alternating series—severe, warm, severe, warm, etc. The opening severe winters in these two series were those of 1872–73 and 1917–18. Thus we examine with interest the records of the winters of 1876–77, 1877–78 . . . , 1882–83, and wonder whether the winters of 1921–22, 1922–23 . . . , 1927–28 will alternate cold, warm, cold, etc., as those of 45 years ago did for such a long period. A study of the weather maps of these winters of the seventies and eighties in conjunction with those of the past few years and of the present might show not only the immediate cause of these alternating winters, but also might give us a hint as to when to expect our present series of alternations to cease."

The article is briefly discussed by H. W. Clough.

Are the seasons changing? C. J. Root (*U. S. Mo. Weather Rev., 49 (1921), No. 1, p. 24*).—A review by decades of records of temperature at New Haven, Conn., from 1780 to 1920, inclusive, seems "to indicate very clearly that since the Revolutionary War at least, there has been no permanent change of temperature."

Weather and crop yields in the United States, C. F. Brooks (*Geogr. Rev., 11 (1921), No. 2, p. 295*).—This is a brief review of a number of recent contributions to this subject including those of Wallace, Blair, Smith, and others (E. S. R., 44, pp. 118, 414, 507.)

Investigations on soil air, P. B. Huber (*Arch. Sci. Phys. et Nat. [Geneva], 5. ser., 2 (1920), pp. 508–510; abs. in Sci. Abs., Sect. A–Phys., 24 (1921), No. 279,* *pp. 165, 166*).—Observations over a gravelly soil are recorded which showed that ionization of the surface air was greater over dry soil than over wet, and greater over loose soil than over compact. It was practically nil over snow. This agrees in general with results reported by Alujic in observations over clay soils, although the absolute values appear to be higher over gravel than over clay soil. The emanations content appears to depend upon the character of the soil.

It was found that the high ionization of the air occurring during the foehn "is not due solely to the descent of strongly ionized air from higher levels, but that at the same time the emanations from the surface are above normal. Other cases of strong ionization are mentioned, which on investigation proved to be confined to a layer 20 to 30 meters above the surface, the ionization at 50 meters being normal. This condition is observed to precede a change of weather."

The observations upon which this article is based were made with a cylindrical sheet-iron receiver 30 cm. wide and high, open at the base, and with a hole about 8 cm. in diameter at the top, through which an electrometer was connected with a plate 15 cm. in diameter and 15 cm. from the ground.

Monthly Weather Review (*U. S. Mo. Weather Rev., 49 (1921), Nos. 1, pp. 52, pls. 18, figs. 8; 2, pp. 53–114, pls. 18, figs. 23*).—In addition to detailed summaries of meteorological, climatological, and seismological data and weather conditions for January and February, 1921, and bibliographical information, reprints, reviews, abstracts, and minor notes, these numbers contain the following contributions:

No. 1.—The Meteorology of the Temperate Zone and the General Atmospheric Circulation (illus.), by V. Bjerknes; The Rapid Fall in Temperature of Cold Waves; Balloon Racing—A Game of Practical Meteorology, by R. H. Upson; Meteorological Aspects of the International Balloon Race of 1920 (illus.), by C. G. Andrus; The Application of Bjerknes Lines to the Development of Secondary Lows (illus.), by C. G. Andrus; Origin of Some Secondary Cyclones on the Middle Atlantic Coast (illus.), by C. F. Brooks; Note on Deep Easterly Winds Over the Middle West on January 24, 25, and 26, 1921 (illus.), by L. T. Samuels; Ice Storm and Gale of January 25–27 at Wilmington, N. C., by R. M. Dole; Dust Cloud Over Drexel, Nebr., January 15, 1921, by H. L. Choate; Further Evidence as to the Western Origin of Dust which Fell in Central States, February 12–15, 1919; Note in Regard to the Clinging Qualities of Snow, by J. R. Weeks; Our Involuntary Climatic Travels (illus.), by J. B. Kincer; Severe Hailstorm in Nebraska (illus.), by H. G. Carter; The R-34 Destroyed in a Gale; and Are the Seasons Changing? by C. J. Root (see p. 16).

No. 2.—Climate of Binghamton, N. Y., Shown by the Histogram Method (illus.), by J. R. Weeks; Temperature Variations in the United States and Elsewhere (illus.), by A. J. Henry (see p. 15); Sequence of Winters in the Northeastern United States (illus.), by C. F. Brooks (see p. 16); A Possible Rainfall Period Equal to One-ninth the Sunspot Period (illus.), by D. Alter; Meteorological Course Given in the Signal Corps School at Camp Alfred Vail, N. J., during 1920, by H. W. Ball; Surface-air and Water Temperatures at Western Bank of Gulf Stream (illus.), by F. G. Tingley; Ocean Rainfall, by H. G. Cornthwaite; Waterspout at San Juan, P. R., by W. C. Haines; The Weather in Finland in 1920—A Warm Year, by L. A. Davis; and Mild Winter of 1920–21 in Northern Europe.

Meteorological observations, 1919, P. Nelson (*Guam Sta. Rpt. 1919, pp. 50–52*).—Observations at the station on temperature, precipitation, humidity, and wind for each month of the year ended June 30, 1919, are summarized in tables, the data for rainfall being compared with the averages for 14 years. The general meteorological conditions are briefly reviewed. Attention is called especially to the severe typhoon which occurred July 6, 1918, and did great damage in the island.

The atmospheric pressure fell to 28.19 in. on the date of the typhoon, as compared with an average monthly mean of 29.8 in. for July. The highest temperature recorded during the year was 99° F. May 4 and the lowest 69° March 8. A temperature of 90° or over was recorded on 143 days during the year. The annual precipitation was 95.77 in. as compared with a 14-year average of 91.86 in. July was the wettest month with a total of 30.53 in., and April the driest with 0.61 in. The maximum daily precipitation of 10.5 in. occurred July 6, the date of the typhoon.

The weather of Scotland in 1919, A. Watt (*Highland and Agr. Soc. Scot. Trans., 5. ser., 32 (1920), pp. 247–258*).—"This report consists of (1) a general description of the weather over the Scottish area from month to month; (2) a selection of rainfall returns, in which each county in Scotland is represented by one or more stations. . . . The outstanding features of 1919 were the great cold experienced in February, March, and November; the late snowstorm at the very end of April; the almost complete absence of summer thunderstorms in the east; and the prolonged spells of dry weather."

Rainfall distribution in France, A. Angot (*Ann. Géogr., 26 (1917), No. 142, pp. 255–272; 28 (1919), No. 151, pp. 1–27; 29 (1920), No. 157, pp. 12–35; 30 (1921), Nos. 163, pp. 32–49; 164, pp. 111–124, pls. 18, figs. 7*).—The available rainfall data are summarized in tables, charts, and diagrams and discussed with reference to monthly and regional distribution. Isohyetal lines are also shown for France as a whole. The average annual rainfall for the country is 832 mm. (32.75 in.), varying from 609 mm. in parts of the north to 1,275 in parts of the southwest. The rainfall is fairly evenly distributed throughout the different months of the year, but averages highest in October, 94 mm., and lowest for February, 53 mm. October is the wettest in almost all regions except certain parts of the southwest and the center where the highest rainfall is in May and June. February is the month of least rainfall in all regions except the Midi, from the Gulf of Gascony to the Alps, where July is the driest month.

Agricultural climatology of Australia, G. Taylor (*Quart. Jour. Roy. Met. Soc. [London], 46 (1920), No. 196, pp. 331–356, figs. 9*).—This article deals with the climate, and especially the rainfall, of different regions of Australia, as well as of Tasmania, with particular reference to the controlling influence of rainfall on agricultural production and consequently on settlement. It covers in large measure the same ground as previous articles by the author (E. S. R., 36, p. 209; 40, p. 716). The article also deals briefly with the relation between rainfall and natural vegetation, and especially with the dependence upon the amount and distribution of the rainfall of wheat, oats, sugar production, corn, barley, vineyards and orchards, hay, potatoes, sheep and cattle raising, and dairy farming. Dry farming and the limits of wheat production, the supply of water for irrigation, the occurrence of disastrous droughts, and the sources of artesian water are also discussed. A short bibliography of the subject is added.

SOILS—FERTILIZERS.

The soils and agriculture of the Southern States, H. H. Bennett (*New York: Macmillan Co., 1921, pp. XVIII+399, pls. 29, figs. 4*).—The author states that this is volume 1 of a series of books which it is hoped will be written to cover the soils of all sections of the United States and their relation to agriculture. This volume covers those States in the cotton belt south of the northern line of Delaware, Maryland, West Virginia, Kentucky, Missouri, and Kansas. It discusses the principal agricultural districts of the Southern States, their geography and topography, and describes their soils with reference to physical and chemical composition, crop adaptations, and farm management.

Soil survey of Lake County, Ind., T. M. BUSHNELL and W. BARRETT (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1917, pp. 48, fig. 1, map 1*).—This survey, made in cooperation with the Indiana Department of Geology, deals with the soils of an area of 314,880 acres in the extreme northwestern corner of Indiana. The area includes three main physiographic divisions, namely, the plain of glacial Lake Chicago, the Valparaiso morainic system and associated till plains, and the outwash plain and lake plain of the Kankakee Basin. It is stated that while the drainage conditions in the county have been revolutionized during the past 15 years, a number of places are still too wet for agricultural or other uses.

The soil material of the county consists of glacial deposits, and the present topography of the central part is almost the direct result of glaciation, little modified by erosion. There are also areas of water-laid soils and recent alluvial soils. Including muck, swamp, dunesand, peat, and pits, 30 soil types of 13 series are mapped, of which the Miami, Carrington, and Brookston silt loams cover 15.3, 12.4, and 11 per cent of the area, respectively.

Minnesota glacial soil studies.—I, A comparison of soils on the late Wisconsin and Iowan drifts, C. O. ROST and F. J. ALWAY (*Soil Sci., 11 (1921), No. 3, pp. 161–205, figs. 13*).—Studies conducted by the Minnesota Experiment Station, in which a comparison was made of the composition and properties of the soils on neighboring areas of two drift sheets in southeastern Minnesota, are reported.

These sheets were the Des Moines Lobe of the late Wisconsin and the older glaciation exposed to the east of this, called the Iowan. The original till of these sheets appeared to have been very similar chemically and physically, and the areas compared are so near each other that it is thought they must have been subjected to the same climatic influences since the recession of the last ice sheet. On each drift 15 virgin soils were sampled, 5 samples being taken from each of 3 soil types, namely, Carrington loam, naturally covered with deciduous forest, and Carrington silt loam and Fargo silt loam, both naturally in prairie. The samples were taken to a depth of 3 ft. in four sections—1–6, 7–12, 13–24, and 25–36 in., respectively.

The Carrington loam soil was found to be the coarsest in texture, slightly the highest in silica, and the lowest in alumina. The Fargo silt loam was the finest in texture and the highest in nitrogen, organic carbon, phosphoric acid, magnesia, and lime, while the Carrington silt loam occupied an intermediate position in texture and content of nitrogen and organic carbon. There was no distinct difference as regards potash and soda. An increase in depth was found to be accompanied generally by an increase in coarseness of texture, regularly by a decrease in nitrogen and organic carbon, and less regularly by a decrease in phosphoric acid. In fields where carbonates were encountered they increased with depth, but where they were absent throughout the 3-ft. section the degree of acidity was not distinctly related to the deph. "When comparisons are made on the basis of the carbonate-free, nonvolatile portion of the soil, with increase in depth iron and magnesia are found to increase slightly, noncarbonate lime to decrease slightly, and silica, alumina, and potash to remain practically constant. The leaching effect upon the mineral constituents originally present in the drift has been practically confined to the carbonates."

Comparing the soils from the two drifts, type by type and level by level, no distinct differences were found in texture or content of silica, alumina, potash, soda, magnesia, noncarbonate lime, nitrogen, and organic carbon. The soils on the older drift are considerably richer in phosphoric acid, especially in the upper levels, and contain appreciably more iron and titanium. The carbonates have been so thoroughly leached from the whole 3-ft. section in the forest fields on both drifts that a distinctly acid reaction is found at all levels. The same holds true of the upland prairie on the older drift, but on part of the fields on the younger drift carbonates are found in the third and even in the second foot. A later exploration of the levels below the third foot showed that on both the upland soil types the depth of leaching out of carbonates is in general somewhat greater on the older drift.

"It would appear that the only distinct influence that the greater age of the Iowan drift has been able to exert upon the soils developed upon it is confined to the leaching out of carbonates to a greater depth, and possibly an enrichment of the surface layers in phosphoric acid through the agency of plants. It appears that in a comparison of the chemical composition of the soils on drift sheets neither of which is older than the Iowan the only distinct difference that may justly be attributed to the difference in age is confined to the relative depth of leaching of carbonates. The greater concentration of phosphate near the surface on the older drift, observed in the areas compared in this study, may not be found elsewhere. It appears probable that the marked differences in content of nitrogen and organic carbon reported from comparisons of soils on Wisconsin and Iowan drifts are due to differences in the vegetation and climate that have been associated with the particular portions of the two sheets employed in the comparison. Both the Iowan and Wisconsin glaciations appear to have been too recent to allow sufficient time for any appreciable leaching out of the original content of potash, of noncarbonate lime and magnesia, or of silica, at least in the case of the till or of the finer textured assorted material from this."

A new classification of the soil moisture, G. Bouyoucos (*Soil Sci., 11 (1921), No. 1, pp. 33–47*).—The object of this contribution, from the Michigan Experiment Station, is to prevent a new classification of the soil moisture founded on experimental and scientific principles, and which appears to show the actual condition of the moisture in the soil. This classification is based upon the principle of the freezing of water.

Soil moisture is classified as gravitational, free, and unfree. The unfree soil moisture is subdivided into capillary-adsorbed and combined, and the combined unfree soil moisture is divided into water of solid solution and water of hydration. The free water is that which freezes for the first time at the supercooling of —1.5° C. The capillary-adsorbed water is that which freezes finally at the supercooling of —4° and at the cooling of —78°, minus the free water. The combined water is that which does not freeze at all even at the temperature of —78°.

On the basis of this classification it was found that in some soils only one or two forms of water exist, while in others all three forms exist but in different proportions. The dilatometer method is considered to be capable of measuring the relative amounts of these various forms of water in the soil, the principle of which is based on the fact that water expands upon freezing. The procedure in this method is described. It was found that repeated freezing and thawing causes some of the unfree water to become free, this belonging entirely to the capillary-adsorbed water.

In the light of dilatometer results, together with those of physiological studies, soil moisture is again classified on a physiological basis into gravitational, free, and unfree moisture. The gravitational water is classified as superavailable and the free water is very available. Of the unfree water the capillary-adsorbed water is classified as only slightly available and the combined water as unavailable. It is also thought that the dilatometer method is capable of determining the wilting coefficient of soils more accurately and definitely than by the means of the plant.

The movement of soil moisture, W. GARDNER and J. A. WIDTSOE (*Soil Sci., 11 (1921), No. 3, pp. 215–232, figs. 11*).—In a contribution from the Utah Experiment Station, a general equation for the movement of moisture through an ideal soil is developed. Two assumptions were made in the development and integration of this equation, namely, (1) the inherent moisture conductivity in an ideal soil is independent of the moisture content, and (2) the capillary potential is a linear function of the reciprocal of the moisture content. The general equation was solved for various special cases, and experimental results obtained from ordinary soils are said to support the general theory. The results are not considered wholly conclusive, however. "Departures from the general equation and its integrated forms that may arise in future investigations may be traced to one or the other of the two assumptions named."

The prevention of soil erosion.—V, The use of concrete, M. H. HOFFMAN and A. W. TURNER (*Iowa Agr. Col. Ext. Bul. 80 (1921), pp. 8, figs. 10*).—In this number of this series (E. S. R., 44, p. 316), the use of solid dams of concrete or masonry for checking erosion is described and diagrammatically illustrated. It is pointed out that a dam should be built with a footing several feet below the bottom of the ditch on a firm foundation with its ends well out into the bank, the middle considerably lower than the ends, and with a downstream curvature of about 120°. The importance of concrete boxes for road culverts where permissible is also recommended.

A pitless lysimeter equipment, W. H. MACINTIRE and C. A. MOOERS (*Soil Sci., 11 (1921), No. 3, pp. 207–213, figs. 5*).—A lysimeter equipment at the Tennessee Experiment Station is described and illustrated, which is considered distinctive in that no surface or subsurface concrete enclosure is required.

Chemical effect of salts on soils, W. P. KELLEY and A. B. CUMMINS (*Soil Sci., 11 (1921), No. 2, pp. 139–159, figs. 7*).—Experiments conducted at the Citrus Experiment Station of the University of California on the influence of salts on light sandy loam and clay loam soils showed that chemically equivalent solutions of the chlorids, sulphates, and nitrates in a given base produced substantially equivalent chemical reactions in the soils.

The solubility of the anion of the neutral salt solutions was not materially affected by the soils studied, but an exchange of bases took place with the result that a portion of the base of the added salt passed out of solution and a chemically equivalent amount of other bases was set free from the soil silicates. With reference to the extent to which the simple salts produce these reactions, the bases stood in the following ascending order: Calcium, sodium, ammonium, potassium, and magnesium. Calcium was the most readily replaced from these soils, but the solubility of magnesium and potassium also was increased to some extent. It was not certain that significant amounts of sodium were set free by any of the salts used.

Considerable amounts of phosphoric acid were precipitated by each of these soils. Chemical reactions took place between soils and alkaline solutions which resulted in the conversion of normal carbonate into bicarbonate, a material lowering of the OH-ion concentration of the solution, and the precipitation of greater amounts of the cation of the solution than takes place with neutral solutions. The reactions between neutral salts and soils are considered to be dependent on the concentration and apparently obey the principle of mass action. Evidence was obtained that the reactions are reversible.

It is suggested that the continued addition of soluble salts in the open field, where the products of the reactions are removed by either the growth of crops or intermittent leaching, must ultimately result in building up a chemical system different from that originally present.

Some studies on the rate of formation of soluble substances in several organic soils, M. M. McCool and L. C. Wheeting (*Soil Sci., 11 (1921), No. 3, pp. 233–247, figs. 4*).—The results of a preliminary study conducted at the Michigan Experiment Station on the relative powers of seven organic soils to form soluble substances at different temperatures under different moisture conditions and at different depths under optimum moisture conditions are reported.

The freezing-point method for the determination of soluble material in the soil solution was used as the means of studying the changes in concentration. It was found that at any given moisture content the effect of a higher temperature is to increase the rate of formation of soluble material, and conversely that lower temperatures decrease the rate of formation. For the higher temperatures, optimum moisture conditions tend to bring greater amounts of material into solution than are found under saturated water conditions. Exactly the opposite effect was observed with lower temperatures.

In general, moist soils upon standing were found to increase in concentration to a certain point, after which a decline occurred. This is considered to be probably due to reabsorption, chemical change to less soluble compounds, or biological activity. Organic soils varied at different depths in the amount of soluble substances present. Different depths also varied in the rate and amount of material made soluble upon standing. Below a depth of 2 ft. the muck soils studied were very inactive. The surface layers were found to usually produce the bulk of the soluble plant foods. As a rule, the ability to yield soluble materials decreased regularly from the surface to the water table. The zone of weathering and the region of greatest activity were found to coincide closely.

The relation of the phosphoric acid of the soil to pot experiments, G. S. Fraps (*Texas Sta. Bul. 267 (1920), pp. 5–53, figs. 2*).—This bulletin deals with the relation between the chemical composition of 95 samples of soils and the results of pot experiments.

The average total weights of four crops grown during two years on soils which received potash and nitrogen but no phosphoric acid increased with the active phosphoric acid of the soil, with the exception of one series. The same conclusion was reached when considering the first crop alone, the first and second crops combined, the first three crops combined, the fourth crop alone, all four crops combined, or the phosphoric acid removed by the various crops. Variation was noted in the amount of phosphoric acid removed or the size of crop grown on different soils containing the same amounts of active phosphoric acid. The total and ignition-soluble phosphoric acid, phosphoric acid soluble in cold 10 per cent hydrochloric acid, active phosphoric acid dissolved by five successive extractions, active potash, lime, acidity, surface or subsoil, and acid consumed were taken into consideration in an attempt to ascertain the causes of these variations.

It was found that there is a tendency for soils containing total phosphoric acid or total nitrogen higher than the average to give higher yields of phosphoric acid to crops than soils with the same quantities of active phosphoric acid but containing the average amounts of total phosphoric acid and nitrogen. Surface soils containing the same amounts of active phosphoric acid on an average gave up more phosphoric acid to crops than subsoils containing corresponding amounts of active phosphoric acid. Exceptions to this relation are noted. There was some tendency for soils containing the same amounts of active phosphoric acid to give up more phosphoric acid to crops as the total phosphoric acid increased, but this difference was not clearly marked. There seemed to be a slight tendency for soils containing equal amounts of active phosphoric acid to give up more phosphoric acid to crops if they contained more nitrogen, which usually meant that they contained more organic matter. Soils with the same content of active phosphoric acid and which were not acid on an average gave up more phosphoric acid and produced larger crops than acid soils. Exceptions to this relation are also noted.

No relations could be observed when soils containing the same amounts of active phosphoric acid were arranged in groups according to the acid consumed, which indicated the amounts of bases present. When the soils were arranged in groups according to the phosphoric acid withdrawn by crops in the pot experiments, there was a better relation between the active phosphoric acid and the crop production than any other character.

Statistical methods showed that there was a better relation between the active phosphoric acid and the phosphoric acid removed by four crops than between the total phosphoric acid in the soil and the phosphoric acid removed by four crops. The correlation coefficient for the active phosphoric acid was 0.57 and for the total phosphoric acid 0.45. There did not seem to be any relation between the active phosphoric acid extracted by five extractions and the relative production in groups arranged according to the active phosphoric acid taken from the soil by groups.

The presence of lime rendered the interpretation of the analyses more difficult, since sometimes it was accompanied by a higher and sometimes by a lower utilization of phosphoric acid in soils of corresponding active phosphoric acid content.

Soils, G. Briggs (*Guam Sta. Rpt. 1919, pp. 35–37*).—Pot and field experiments to compare the productiveness of old and newly broken soils and to study their fertilizer requirements showed that while there was scarcely any difference in the chemical analyses of these soils the old soil gave the largest yields of corn, kafir, cotton, cowpeas, radishes, peppers, and rice. The second crop showed smaller differences than the first, indicating that the new soils increased in productivity.

Commercial fertilizers and fertilizers of local origin, including barnyard manure, lime, green manure, coconut husk ash, sea slugs, seaweeds, and bat guano were tested in pot experiments, indicating that certain of the local products gave equally as good results as some of the commercial fertilizers. Manure was very beneficial to both old and new soils. Lime on the old soil and bat guano on the new soil produced a good growth of corn, while seaweeds, coconut husk ash, and certain combinations of commercial fertilizers containing acid phosphate were noticeable in their beneficial effects.

Vegetation experiments with different potash fertilizer salts and on phosphoric acid and lime fertilization, E. A. Mitscherlich, S. von Saucken, and F. Iffland (*Landw. Jahrb., 53 (1919), pp. 501–514, pls. 4*).—Pot experiments with potassium chlorid on sand with oats are reported, which showed that the best results were obtained when the ratio of potash to nitrogen used was 1 : 4. No injurious influence of potassium chlorid was evident either with an excess or a minimum application of nitrogen.

In experiments with the sulphate, nitrate, and carbonate of potassium and primary and secondary potassium phosphates, the highest yields of oats were obtained with the maximum applications of all the fertilizers, but this was not true with potassium chlorid. The relative values of the different salts varied widely. The potassium carbonate gave the best results, followed in order by the potassium sulphate and potassium nitrate.

Experiments with oats on the influence of lime on the activity of the phosphoric acid in tricalcium phosphate, Thomas meal, and Anguar phosphate showed that gypsum apparently had no effect, while calcium nitrate strikingly decreased the activity of the phosphoric acid. Thomas meal was affected less than the other phosphates. With carrots, oats, and peas, the three phosphates produced results with all three crops in the ratio of 1: 0.47: 0.1.

When dicalcium and tricalcium phosphates were applied to oats to determine the influence of watering with tap and distilled waters, the total yield was always greater with tap water, but the difference was small. However, with tap water the grain yield was about 50 per cent of the total yield and with distilled water only about 33 per cent.

Keeping soils productive, R. R. Hudelson (*Missouri Sta. Circ. 102 (1921), pp. 24, figs. 8*).—Popular information for the use of farmers on maintaining the fertility and producticity of Missouri soils, based on the summarized results of work at the station, is given.

Data on the composition and loss of plant nutrients from these soils are summarized, indicating that many of them are distinctly deficient in nitrogen and phosphorus. Potassium is abundant in most soils although frequently insoluble, and it is considered advisable to increase the availability of soil potash by proper treatment rather than by actual additions.

Information is given on the use of green and stable manures and crop residues, and on the growing of legumes, and it is stated that both acid phosphate and bone meal have given excellent results on nearly all these soils. Raw rock phosphate has not given as satisfactory returns on these soils as steamed bone meal or acid phosphate, and when used it should be purchased under a guaranty that at least 90 per cent will pass through a 100-mesh sieve. One of the most urgent soil problems of Missouri is said to be that of maintaining a supply of lime.

Information is also given on the selection and use of commercial fertilizers.

Fertilizers and manures, A. D. Hall (*New York: E. P. Dutton & Co., 1920, pp. XVI+384, pls. 7*).—This book is intended to supplement a previous one on The Soil (E. S. R., 43, p. 621), and is written in nontechnical language for farmers and students. Its purpose is to give practical information on the use of fertilizers and manures. A great deal of the information presented is based on the results of work at the Rothamsted Experimental Station. Chapters are included on fertilizers containing nitrogen, the function and comparative value of nitrogenous manures, phosphatic manures, the function and use of phosphatic fertilizers, the potassic fertilizers, farmyard manure, Peruvian guano and other mixed fertilizers, materials of indirect fertilizing value, theories of fertilizer action, systems of manuring crops, the valuation and purchase of fertilizers, and the conduct of experiments with fertilizers.

Phosphate rock in 1919, R. W. Stone (*U. S. Geol. Survey, Min. Resources U. S., 1919, pt. 2, pp. [2]+211-225*).—This bulletin reports data on the production and export of phosphate rock in 1919 and on foreign phosphate deposits.

It is stated that the phosphate rock sold in the United States in 1919 amounted to 2,271,983 long tons, valued at $11,591,268. As compared with the production in 1918, this was a decrease in quantity of 9 per cent and an increase in value of approximately 41 per cent. The total quantity of phosphate rock mined in 1919 was 1,851,549 long tons, a decrease of nearly 19 per cent from the output in 1918.

Stocks reported on hand at the end of 1919 were about 555,000 long tons, or a decrease of about 50 per cent from 1918. In 1919 there was an increase in quantity of phosphate rock sold in South Carolina, Tennessee, Idaho, and Utah, and an increase in value in all the producing States except Kentucky. The quantity of phosphate rock exported from the United States in 1919 was 378,731 long tons.

The storage and handling of potash, G. F. Zimmer (*Chem. Age [London], 4 (1921), No. 82, pp. 34-37, figs. 7*).—Methods and machinery for the storage and handling of potash salts in large amounts are described and illustrated.

Lime: Definitions and specifications (*U. S. Dept. Com., Bur. Standards Circ. 106 (1920), pp. 15*).—Definitions of the generally used terms relating to compounds of calcium are given, with particular reference to agricultural limes.

The transformation of caustic lime in soil and the solubility of the lime compounds formed in their relation to the theory of lime action, G. Hager (*Jour. Landw., 65 (1917), pp. 245-311, fig. 1*).—Extensive studies conducted at the University of Göttingen are reported which failed to confirm the assumption that burnt lime changes completely into calcium carbonate in a short time in soil. Only a part of the lime combined with carbon dioxid, the remainder being adsorbed by the soil particles and leaving no free calcium hydroxid in the soil after a short time. The alkaline reaction of limed soil is attributed, in addition to calcium carbonate, to the calcium hydroxid separated again from the soil particles in small quantities by the action of water. It was not determined whether the lime adsorption was due to surface action or chemical causes or both.

Liming increased the adsorptive power of soils for other bases, such as potash and ammonia. The higher the content of fine particles in soil and the less adsorptively saturated it was, the greater were the amounts of lime fixed by the soil constituents. That part of the lime combining with carbon dioxid increased as the amounts of lime added increased. Generally, an equilibrium between the combining power of carbon dioxid in soil and the adsorbing power of soil was reached in a short time.

Calcium carbonate was transformed more slowly in soil than burnt lime. Caustic lime is therefore considered to be adapted for use on adsorptively unsaturated soils. Lime combined with carbon dioxid and with soil constituents was dissolved out by soil water containing carbon dioxid. It was also leached out in both combinations. The compounds formed by caustic lime in soil were not dissolved as rapidly by water containing carbon dioxid as artifically prepared aragonite.

It is the author's opinion that the greater activity of burnt lime in soil can not be attributed wholly to greater solubiltiy of its combinations with soil. More probably the lime adsorbed by soil constituents stands in some relation to the soil crumb structure. This point needs further study.

In dry soil rich in fine particles, such as loam and clay soils, enough water remains to slake caustic lime, resulting in a lime solution which can not be duplicated by the action of calcium carbonate and water containing carbon dioxid. Adsorption results in an energetic crumb formation, which eventually causes a change in the physical structure of the soil.

Sulphur and sulphur composts in relation to plant nutrition, W. E. Tottingham and E. B. Hart (*Soil Sci., 11 (1921), No. 1, pp. 49-73, figs. 6*).—In a contribution from the University of Wisconsin, experiments are reported on the application of the procedure of composting floats with manure or soil. A silt loam soil and a garden soil, prepared by composting silt loam with manure, leaf mold, and sod, were used.

It was found that soil composts with sulphur added developed much acidity in 32 weeks, which was greater where sulphur was used alone than where rock phosphate also was added. Dissociated acid formed but a small portion of the total acid. Composts of sulphur with horse manure showed appreciable increases in acidity but no increase in citrate-soluble phosphoric acid after 15 weeks.

Sulphur decreased the loss of organic matter in manure by fermentation. Increased bacterial counts in these composts were maintained to the conclusion of 12.5 weeks. Acidity doubled in the rock phosphate and sulphur compost over this period, but was unchanged after 4.5 weeks. The variations of water-soluble sulphate were in the same direction as those of acidity, increasing where sulphur was added and decreasing in the other cases. Citrate-soluble phosphoric acid approximately doubled where sulphur was added, the percentage being based upon the common basis of original dry matter of the composts. In the other cases the percentage of this constituent decreased approximately one-half.

Yields of oats from soil cultures to which these composts were applied agreed generally with the results of analysis of the latter, producing the greatest yields where sulphur had been applied. On sandy loam the yield of seed where sulphur compost was applied was as great as where the corresponding treatment included rock phosphate. Increased yields of oats were obtained also from the application of rock phosphate and sulphur with fermented manure.

Similar composts which fermented 18.5 weeks showed 60 per cent greater availability of phosphoric acid (solubility in ammonium-citrate solution) by the addition of sulphur to rock phosphate. When aerated by weekly mixing the corresponding increase of available phosphoric acid was 90 per cent, although the total acidity was decreased thereby. The total acidity developed in the complete compost was nearly as great as that resulting from an equivalent addition of acid phosphate to the fermented manure. In this experiment the use of sulphur alone did not increase the proportion of citrate-soluble phosphoric acid in the manure. Application of these fermented manures and composts to sand cultures of barley led to equal yields from the rock phosphate and sulphur compost and a corresponding portion of fermented manure supplemented by acid phosphate. These yields were not superior to those from sulphur compost and manure reinforced by rock phosphate and sulphur.

The process of sulfofication was inactive after 12 weeks, but became very active after 18 weeks.

In greenhouse trials on silt loam and sandy loam with clover and Cruciferae, sulphur increased growth on the former soil, 100 lbs. per acre being as effective as more. Barley on field plats of sandy silt loam apparently in need of lime produced increased yields of seed by the application of sulphur. Sulphur alone was as effective as its combinations with marl and rock phosphate, and 100 lbs. of sulphur per acre was as effective as 50 or 300 lbs. Calcium sulphate produced better yields of oats upon silt loam than equivalent amounts of sodium sulphate or sulphur when these supplemented the usual complete fertilizer in greenhouse cultures. Liming depressed the efficiency of calcium sulphate under these conditions, and 100 lbs. of elemental sulphur was more effective than either one-third or three times as much. Benefits from elemental sulphur were not apparent when it was superimposed upon the sulphates for application.

"It appears probable that sulphur functions as a fertilizer both by oxidation to the nutrient SO_3 and by producing, through oxidation, an acid condition favorable to the production of available P_2O_5. These processes occur in composts of sulphur and rock phosphate. They also, doubtless, continue when the compost materials are tilled into the soil. It remains to be proved whether the efficiency of sulphur is any greater when it is composted with rock phosphates and manure than when these materials are added simultaneously to the soil. Adequate consideration of the use of sulphur as a fertilizer must recognize its tendency to deplete the stock of CaO, P_2O_5, and other soil constituents."

Inoculated sulphur as a plant-food solvent, J. G. Lipman, A. W. Blair, W. H. Martin, and C. S. Beckwith (*Soil Sci., 11 (1921), No. 2, pp. 87–92*).—Experiments conducted by the New Jersey Experiment Stations are reported, showing that inoculated sulphur is apparently more effective than uninoculated sulphur for rendering inert mineral plant food available to growing crops. Mixtures of inoculated sulphur and ground phosphate rock gave better results than phosphate rock alone.

Commercial fertilizers, 1919–20, W. H. Dore (*California Sta. Bul. 327 (1920), pp. 93–127*).—This bulletin contains the results of actual and guarantied analyses and valuations of 365 samples of fertilizers and fertilizer materials collected for inspection in California during the fiscal year ended June 30, 1920, together with a list of registered manufacturers and dealers. Of the total number of valuations reported, 64 per cent were above the amount guarantied and 36 per cent below. There were 26 deficiencies in available phosphoric acid, 56 in total nitrogen, 4 in potash, and 43 in valuation.

Analyses of commercial fertilizers, fertilizer supplies, and home mixtures, 1920, C. S. Cathcart et al. (*New Jersey Stas. Bul. 344 (1920), pp. 5–47*).—This bulletin contains actual and guarantied analyses of 566 samples of fertilizers and fertilizer materials collected for inspection in New Jersey during the spring of 1920. These included 86 brands of fertilizer materials, 7 home mixtures, 339 brands of commercial fertilizers containing nitrogen, phosphoric acid, and potash, 122 brands containing nitrogen and phosphoric acid, and 12 duplicates.

Commercial fertilizers in 1919–20, G. S. Fraps and S. E. Asbury (*Texas Sta. Bul. 265 (1920), pp. 3–25*).—This bulletin contains the results of actual and guarantied analyses and valuations of 420 fertilizers and fertilizer materials collected for inspection in Texas during the year ended September 1, 1920, together with a list of brands registered for sale in the State during the year.

AGRICULTURAL BOTANY.

Normal and abnormal germination of grass fruits, J. Zinn (*Mitt. Landw. Lehrkanz. K. K. Hochsch. Bodenkul. Wien, 2 (1914), No. 4, pp. 675–712, pls. 8; abs. in Maine Sta. Bul. 294 (1920), pp. 195–216, pls. 4*).—A description is given of the processes that take place at the time of emergence of the radicle of hulled grass fruits from the surrounding tissues.

The penetration of the germinating embryo through the tissues of the adhering pericarp is said to be a purely mechanical process. In normal germination the coleorhiza breaks through the base of the fertile glume within a zone whose mechanical resistance is greatly lessened by the reduction and differentiation of the epidermal and hypodermal cells. The prosenchymatous tissue yields along lines of contact of the long schlerenchymatous cells. Likewise, the epidermis is ruptured in a region where cells marked by different morphological forms and physical structure meet. In both cases the cells are pushed apart.

The abnormal germination of hulled grass fruits is said to be caused by external mechanical factors which so operate as to thwart and eliminate the growth tendency of the radicle in the normal direction.

The chief function of the coleorhiza is said to be its mechanical performance in breaking through the tissues of the glume, and its further function as a protective organ for the tender radicle. The radicle emerges from the coleorhiza through a longitudinal opening formed by the cells being detached and pushed apart without being injured in any way.

Abnormal conditions in [planting] seed, M. HOLLRUNG (*Kühn Arch.*, 8 *(1919), pp. 352*).—This is a systematic account of conditions related to germinability in seeds, including after-ripening, rest period, germination, and different forms of seed treatments as applied to cereals, beets, potatoes, legumes, and other plants.

Antagonistic reactions and rôle of the callus in grafted plants, L. DANIEL (*Compt. Rend. Acad. Sci. [Paris], 170 (1920), No. 25, pp. 1512–1515*).—The author concludes from his studies that the callus contributes in a considerable part to modify the biological state of both stock and graft and to determine a clearly marked antagonism, giving rise to the formation of reparatory organs. These are discussed as to their function and probable significance.

Immunity of annual plants to symbiotic fungi, J. MAGROU (*Compt. Rend. Acad. Sci. [Paris], 170 (1920), No. 10, pp. 616–618*).—A study of several plants along lines suggested in work previously noted (E. S. R., 30 p. 730) is considered to justify the view that symbiosis depends upon the conditions of resistance by the mycelial body to something similar to phagocytosis in the higher plants. Immunity is correlated with the destruction of that mycelium.

The necessity of vitamins to the development of plants, A. LUMIÈRE (*Compt. Rend. Acad. Sci. [Paris], 171 (1920), No. 4, pp. 271–273*).—Studies cited with discussion are considered to show that vitamins are substances indispensable to life, being incapable of replacement by any chemical substance.

Influence of the carbon source upon the utilization of nitrogen by Bacillus subtilis, E. AUBEL (*Compt. Rend. Acad. Sci. [Paris], 171 (1920), No. 9, pp. 478–480*).—It is claimed, on the basis of the data here presented, that under these conditions the nature of the carbon source exercises a distinct influence on the utilization of nitrogen by *B. subtilis*. An increased yield was associated with glycerin over that with levulose, which was in turn greater than that with glucose.

Influence of small amounts of potassium on physiological characters of Sterigmatocystis nigra, M. MOLLIARD (*Compt. Rend. Acad. Sci. [Paris], 170 (1920), No. 16, pp. 949–951*).—A study of *S. nigra* growing in a nutritive medium containing a small amount of KH_2PO_4 shows a marked specific action on the development of the fungus in ways which are detailed.

The action of chlorin and other vapors on plants, P. GUÉRIN and C. LORMAND (*Compt. Rend. Acad. Sci. [Paris], 170 (1920), No. 7, pp. 401–403*).—Experimentation testing the effects of several military gases on different plants showed that exposure for one to two hours to an atmosphere containing small quantities of chlorin, palite, bromacetone, chloropicrin, and mustard gas caused temporary loss of leaves without any apparent permanent injury to the plant itself. The effect on the leaves appears to be due to marked plasmolysis or protoplasmic contraction produced. In cherry laurel subjected to chlorin the change is followed by disengagement of hydrocyanic acid, and in *Aucuba japonica* by very intense blackening of the leaves.

Action of chloropicrin on higher plants, G. BERTRAND (*Compt. Rend. Acad. Sci. [Paris], 170 (1920), No. 14, pp. 858–860*).—The author adds to the above report an account of studies by himself on the effects of chloropicrin as noted in connection with such plants as pear, elm, poplar, lilac, grape, cherry laurel, and spindle tree. These plants or portions thereof were subjected to chloropicrin under varying conditions. The results are detailed with discussion.

Plasmolytic effect of vapors, P. Guérin and C. Lormand (*Compt. Rend. Acad. Sci. [Paris], 170 (1920), No. 26, pp. 1598–1601*).—The authors have been able in the course of the study here reported (as a continuation of those above noted) to confirm most of the conclusions previously announced by Mirande (E. S. R., 24, p. 139). Details are added regarding the effects of different poisons on plants.

Anthracene as a tar constituent injurious to plants, R. Ewert (*Jahresber. Ver. Angew. Bot., 15 (1917), No. 2, pp. 170–172*).—The author concludes as a result of studies indicated that anthracene itself is the most injurious of its group to plants, causing a characteristic form of injury.

Action of hydrocyanic acid [on seeds and on parasitic organisms], J. Stoklasa (*Compt. Rend. Acad. Sci. [Paris], 170 (1920), No. 23, pp. 1404–1407*).—Tests applied to seeds of economic plants indicate that hydrocyanic acid as here uesd is an excellent disinfectant for seeds, increasing development and yield.

Comparative study of microflora and nitrogen content of soils partially sterilized with calcium sulphid, G. Truffaut and N. Bezssonoff (*Compt. Rend. Acad. Sci. [Paris], 171 (1920), No. 4, pp. 268–271*).—In three series of experiments employing considerable quantities of sulphid and carbid in connection with cultures of wheat, endive, and turnip in porous pots giving constant aeration, the porous medium was found to favor (though decreasingly with the lapse of time) the loss of ammoniacal nitrogen by diffusion, but to hinder the continued development of anaerobic bacteria, such as *Bacillus butyricus*.

Under conditions of culture in the open field, using 150 kg. calcium sulphid per hectare (133.5 lbs. per acre), the soil did not become poor in nitrogen despite a considerable removal of that element.

Absorption of calcium by plant roots and its antitoxic properties toward copper, L. Maquenne and E. Demoussy (*Compt. Rend. Acad. Sci. [Paris], 170 (1920), No. 8, pp. 420–425*).—Having noted in a previous communication (E. S. R., 39, p. 526) a preponderant and specific action of calcium on the development of growing plants, the author set out to investigate the relation between this effect and the neutralizing effects of calcium on copper compounds, which are ordinarily injurious when used alone.

It is found by repeated tests that calcium, even in excess, does not oppose either the absorption of copper by the roots or its diffusion in the aerial portions. The presence of copper does not hinder the assimilation of calcium. The action of calcium in connection with copper appears to be physiological. It favors the diffusion of the latter, probably preventing, within limits, its undue accumulation at any point.

A case of favorable action of copper on vegetation, L. Maquenne and E. Demoussy (*Compt. Rend. Acad. Sci. [Paris], 170 (1920), No. 26, pp. 1542–1545*).—Having found in work previously noted (E. S. R., 44, p. 825) that copper is widely distributed in the tissues of plants, the authors have carried out studies in sterile media with peas, lettuce, and wheat. While the experimentation noted is not regarded as establishing an alimentary value for copper, it is regarded as proving that in certain media and under certain conditions copper exerts an antitoxic function, as does calcium in connection with certain other metals throughout a wide range of conditions.

Iron as toxic [to plants] and copper as antitoxic, L. Maquenne and E. Demoussy (*Compt. Rend. Acad. Sci. [Paris], 171 (1920), No. 4, pp. 218–222*).—Data presented, showing the antagonistic effects of copper and the injurious effects of iron on plant roots, suggest several practical applications.

[Osmosis in plant physiology], P. Lesage (*Compt. Rend. Acad. Sci. [Paris], 171 (1920), No. 6, pp. 358–360*).—Having employed acetocellulose as an osmotic membrane in the repetition of experimentation by others on osmosis and aspiration due to evaporation, the author discusses the data and offers suggestions regarding their scientific and practical bearings.

Studies on the evolution of protoplasm in plants, V. Galippe (*Compt. Rend. Acad. Sci. [Paris], 170 (1920), No. 6, pp. 342–345*).—Culture studies briefly noted as applying to cells from the floral epidermis of Iris, tulip, and other plants are said to show that the living part of the protoplasm is constituted by microzymes.

Cytoplasmic elements, A. Guilliermond (*Compt. Rend. Acad. Sci. [Paris], 170 (1920), No. 10, pp. 612–615, figs. 5*).—The author describes the chondriomes in contrast with other and somewhat similar bodies observable in the cell, in particular as regards their reactions to stains. Vegetable cells are said to show, in addition to globules presumably lipoid in character (having nothing in common with chondriosomes), a vacuolar apparatus called the vacuome by Dangeard (E. S. R., 44, p. 822), showing mitochondrial forms, and chondriomes similar to those of animals, and represented by two varieties of mitochondria.

Structure and metabolism of vegetable cells, P. A. Dangeard (*Compt. Rend. Acad. Sci. [Paris], 170 (1920), No. 12, pp. 709–714*).—The author discusses his own views regarding three cell constituents as previously noted (E. S. R., 44, p. 822), with critical notes on the conclusions of Guilliermond, noted above.

The structure of plant cells, A. Guilliermond (*Compt. Rend. Acad. Sci. [Paris], 170 (1920), No. 25, pp. 1515–1518*).—A reply to the article noted above.

Vacuome, plastidome, and spherome in Asparagus, P. A. Dangeard (*Compt. Rend. Acad. Sci. [Paris], 171 (1920), No. 2, pp. 69–74, figs. 16*).—The author utilizes the terms previously introduced by himself (E. S. R., 44, p. 822), in describing cellular constitution in *A. verticillatus*, which was studied in this connection. The characters of three constituents named are separately detailed, and the changes undergone are briefly noted.

Cytological study of the sexual organs of ferns, L. Emberger (*Compt. Rend. Acad. Sci. [Paris], 171 (1920), No. 16, pp. 735–737*).—The author reports that the sexual organs of ferns show clearly in certain stages the existence in cells of the chrondriome composed of two varieties of mitochondria, which preserve their individuality throughout their development. One form represents the mitochondria destined to develop as plastids, the other mitochondria unknown as to function.

The evolution of chondriome and of plastids in the Fucaceae, G. Mangenot (*Compt. Rend. Acad. Sci. [Paris], 170 (1920), No. 3, pp. 200, 201, fig. 1*).—From the same point of view as that held in the previous communication (E. S. R., 44, p. 823), the author now deals with the reproductive organs of Fucus.

It is stated that the evolution of the chondriome and of plastids in the Fucaceae is associated with the persistence of phaeoplasts throughout the whole developmental period of the plant. However, the phaeoplasts of young tissues and of reproductive organs are minute in size and very sensitive to chemical agents, differing clearly from the larger phaeoplasts occurring in the peripheral cells.

It is stated that there exists along with these plastids, in all of the cells, a chondriome made up exclusively of granular mitochondria, the functions of which remain unknown.

Evolution of the chondriome in vascular cryptogams, L. Emberger (*Compt. Rend. Acad. Sci. [Paris], 170 (1920), No. 5, pp. 282–284, figs. 5*).—Observations cited are said to show the existence of two distinct varieties of mitochondria in the root meristem of *Athyrium filixfemina.* These varieties show practically the same forms, but differ somewhat in size and in intensity of coloration. Of these varieties, the more numerous comprises young plastids; the other, mitochondria of unknown significance as regards their functions.

Evolution of the chondriome in the formation of the sporangium of ferns, L. Emberger (*Compt. Rend. Acad. Sci. [Paris], 170 (1920), No. 8, pp. 469–471, figs. 7*).—Study of *Scolopendrium vulgare* and *Asplenium ruta-muraria* from the evolutionary point of view, as indicated in the study noted above, shows in all stages of development of the cell the two varieties of mitochondria previously mentioned. Evidence of mitochondrial reversibility is apparent in the cell changes involved in the development of the sporangium.

Evolution of the chondriome during the formation of pollen grains, A. Guilliermond (*Compt. Rend. Acad. Sci. [Paris], 170 (1920), No. 17, pp. 1003–1006, figs. 11*).—A study of the appearance of the chondriomes during the formation of pollen grains of *Lilium candidum* is briefly detailed.

Observations on chondriomes in living cells, A. Guilliermond (*Compt. Rend. Acad. Sci. [Paris], 170 (1920), No. 22, pp. 1329–1331, figs. 5*).—A study of cellular elements in *Saprolegnia* sp. is discussed, including the technique and results of employment of different colorants.

The chondriome in Vaucheria, G. Mangenot (*Compt. Rend. Acad. Sci. [Paris], 170 (1920), No. 24, pp. 1458, 1459*).—Three sorts of granulations are briefly indicated as distinguishable in Vaucheria. The evolution of the chondriome in plants is held to prove that chloroplasts should be considered as mitochondria adapted to chlorophyll assimilation.

Period required for the development of chlorophyll in maximum light intensity, H. Coupin (*Compt. Rend. Acad. Sci. [Paris], 170 (1920), No. 12, pp. 753, 754*).—Studies continuing those previously noted (E. S. R., 44, p. 824) on several garden and other plants show that the time required to obtain maximum green coloration in leaves or cotyledons varies from 1 to 5 days, that required for other portions being 3 to 15 days. In no case was maximum coloration obtained in less than one full day of sunshine.

Action of radiations of different wave lengths on chlorophyll, R. Wurmser (*Compt. Rend. Acad. Sci. [Paris], 170 (1920), No. 26, pp. 1610–1612*).—Details are given in tabular form with discussion for the red, green, and violet portion of the spectrum regarding absorbed energy, velocity of reaction, ratios between these two, constant of absorption, and photochemical sensitivity observed in the study of chlorophyll prepared according to the method of Willstatter and Stoll.

Action of light waves of different lengths on chlorophyll assimilation, R. Wurmser (*Compt. Rend. Acad. Sci. [Paris], 171 (1920), No. 17, pp. 820–822*).—Having followed the changes in alkalinity of sea water containing algae (*Rhodymenia palmata* and *Ulva lactuca*) exposed to light waves of different lengths, the author reports having demonstrated the existence of two maxima. The red pigment of algae is associated with assimilation occurring at low intensities as regards luminosity.

Resistance of plants to starvation, H. Coupin (*Compt. Rend. Acad. Sci. [Paris], 171 (1920), No. 12, pp. 550, 551*).—Higher plants deprived of light showed exhaustion after periods ranging from 15 days for Provence alfalfa to 60 days for pignon pine (*Pinus pinea*).

Phenomena of torsion comparable to the twisting of tendrils produced experimentally, H. Ricome (*Compt. Rend. Acad. Sci. [Paris], 170 (1920), No. 23, pp. 1399–1401*).—It is stated that torsions comparable to twisting of tendrils may be produced by geotropism in a plant, and that heliotropism may be employed to give a similar effect.

Orientation of branches in space, H. Ricome (*Compt. Rend. Acad. Sci. [Paris], 171 (1920), No. 16, pp. 734, 735*).—The author holds that the orientation of branches, under the influence of gravity, depends upon the content of water at disposal to allow for the effects of its unequal distribution as determining weight.

The transmission of fasciation and of dichotomy, J. D. D'Oliveira (*Compt. Rend. Acad. Sci. [Paris], 170 (1920), No. 10, pp. 615, 616*).—The alleged transmission, by grape stock to graft, of the two specific characters fasciation and dichotomy is recorded with discussion.

Production by traumatism of a new form of maize having multiple caryopses, L. Blaringhem (*Compt. Rend. Acad. Sci. [Paris], 170 (1920), No. 11, pp. 677–679*).—Out of one of the groups derived from a culture of *Zea mays* separated about 1903, after wounding the principal stem (E. S. R., 18, p. 732; 19, p. 1128), the author isolated a strain having crinkled leaves, also the line designated as *Z. mays polysperma*, having two or three caryopses intimately fused together. He gives a brief account of how he obtained, among the strains arising from seed developing in a terminal inflorescence (fasciated) a new form of maize showing heredity of that character. This is considered a typical example of inheritance of acquired characters.

[Peloria], L. Blaringhem (*Compt. Rend. Acad. Sci. [Paris], 171 (1920), No. 4, pp. 252–254*).—A study of the nature and heredity of peloria in *Digitalis purpurea* concludes with a claim that this is a case of hereditary fasciation. Partial sterility also appears as a feature of the case in question.

FIELD CROPS.

Forage crops in western Kansas, R. E. Getty (*Kansas Sta. Bul. 225 (1921), pp. 3–54, figs. 10*).—Cultural and field practices applicable to the production of forage crops in the western half of Kansas are described. The information presented in this publication was derived from variety and cultural experiments conducted at the Fort Hays Substation in cooperation with the Office of Forage Crop Investigations of the U. S. Department of Agriculture from 1913 to 1919, inclusive. Data on environmental conditions and experimental results are tabulated and discussed, together with notes on insects and rodent pests.

Sorghums have proved most productive, particularly in dry seasons, with the heaviest forage yields given by the sweet sorghums (sorgos). Red Amber sorgo in a 6-year test gave an average acre yield of 3.45 tons of cured fodder, while corn produced only 1.52 tons. Red Amber made 3.57 tons of hay per acre, while German millet yielded 61 per cent and Sudan grass 76 per cent as much. Sumac, Orange, Western Orange, and improved Black Amber are also valuable sorgos, but seldom equal to Red Amber.

For both grain and forage, Pink, Sunrise, and Dawn kafirs are recommended as the best varieties; for grain alone, feterita, milo, and Freed are better adapted, especially under adverse conditions.

Between May 15 and June 15 is usually the best time to plant sorghums for grain and forage, but early varieties may be planted for forage up to July 1. Varying the rates of seeding affected forage yields but little when the land was well occupied. For hay, close drilling sorgo at the rate of 30 to 40 lbs. per acre has been found to be a good practice in favorable seasons. Spacing sorghum plants 4 to 8 in. apart in the row for forage, and 8 to 12 in. apart for grain in rows 3 to 3.5 ft. apart, are recommended for best results. Analyses of Red Amber sorghum hay, cut at four stages of maturity, are reported.

The culture of Sudan grass for hay and pasture is advised in the place of much of the millet now grown. Seeding between May 15 and June 15 is held best, but good yields have been obtained at Fort Hays when planted as early as May 1 and as late as July 15. For hay, Sudan grass should be seeded at the rate of 15 to 20 lbs. per acre in close drills, or 3 to 4 lbs. per acre in rows 3.5 ft. apart, and cut between the first head and the full-bloom stage. Although an uncertain seed crop, profitable yields are sometimes obtained. For seed, the crop should be planted in rows. Analyses of Sudan grass hay, cut at different stages, are reported.

German or Golden millet yields the most hay, but earlier varieties such as Kursk, Siberian, common, Hungarian, and Goldmine are more drought resistant. Grasses failed to give good results when seeded for permanent hay or pasture. Although once considered promising, brome grass is unsuited for land too dry for alfalfa.

Alfalfa is the most desirable forage crop to grow on irrigated land or on unirrigated bottom land, but is rarely profitable on dry uplands with an annual rainfall of 25 in. or less. Common alfalfa is preferred to other varieties. Biennial white sweet clover is suggested for pasture on bottom lands too sandy or too close to ground water for alfalfa, but is not recommended for upland conditions. Drilling from 10 to 15 lbs. per acre from April 15 to May 15 is considered the best practice in obtaining stands of alfalfa and sweet clover. Analyses of sweet clover and alfalfa leaves and stems are reported.

Results with the annual legume crops, including field peas, cowpeas, soy beans, tepary, and pinto beans, vetch, chick-peas, and Spanish peanuts, do not warrant their general planting.

Sunflowers, sugar beets, mangel-wurzels, turnips, rape, Tunis grass, Johnson grass, and sainfoin have been found less profitable than other plants that meet the same needs. Russian thistles may be used as an emergency hay crop, but their seeding is not advised.

[Report of field crops work in St. Vincent, 1918–19], F. WATTS (*West Indies Imp. Dept. Agr. St. Vincent Agr. Dept. Rpt., 1918–19, pp. 6–8, 8–12, 20–30*).—Fertilizer experiments with Sea Island cotton and arrowroot, breeding work with cotton, cowpeas, bonavist bean (*Dolichos lablab*), and castor bean are reported, in continuation of previous work (E. S. R., 41, p. 528). Tabulated statistics are presented and discussed regarding the production of cotton, arrowroot and cassava starch, cacao, sugar, corn, coconuts, peanuts, and peas on the island.

Mulching arrowroot with Gliricidia prunings gave an average acre yield of 61,005 lbs. of rhizomes, compared with 17,845 lbs. from untreated plats. In comparisons of various organic and artificial fertilizers, a mulch of Gliricidia prunings led, producing 60,798 lbs. per acre, and was followed by sulphate of potash, 27,183 lbs., with 19,194 lbs. from the untreated check.

[Report of field crops work in British Guiana], J. B. HARRISON (*Brit. Guiana Dept. Sci. and Agr. Rpt., 1918, pp. 4–20*).—Experiments with sugar cane and rice described for the year ended December 31, 1918, in continuation of previous work (E. S. R., 41 p. 528), have been already noted (E. S. R., 43, p. 532; 44, p. 136) from other sources.

[Report of agronomy work at the Guam Station, 1919], G. BRIGGS (*Guam Sta. Rpt., 1919, pp. 23–30, 31, 32, 33, 34, 35, pls. 2*).—The continuation of work with field crops along the same general lines as heretofore (E. S. R., 42, p. 31) is described. The typhoon of July 6, 1918, which destroyed nearly all of the growing crops on the island; excessive rains following for three months; and an extended drought occurring during the last half of the year, combined to render the agronomic work very disappointing.

In fertilizer tests with Para grass, barnyard manure alone gave the most lasting results, and was followed in effectiveness by applications of large amounts of commercial fertilizer. Para grass planted with velvet beans produced 1,298 lbs. of green forage for the first crop and 3,220 lbs. for the second crop, as compared with 760 and 805 lbs., respectively, from plats of grass alone.

Paspalum grass withstood the typhoon, heavy rains, and extreme drought, and remained in better shape than any other grass or forage crop on the island. Cuttings of seed stems planted in boxes produced good growth, demonstrating that Paspalum can be propagated from seed stems as well as from seed and by root division. Work with Guinea grass, Sudan grass, Bermuda grass, and Guatemala grass (*Tripsacum laxum*) is also noted.

The sixth cutting of ratoon kafir yielded 2,292 lbs. of forage per acre, while that of ratoon sorghum produced 4,224 lbs. Feterita and yellow milo were the earliest of the grain sorghums, while Dawn and Blackhull were the most promising of the kafirs. Dawn kafir was outstanding in yields of seed and forage. Orange gave the best results in a limited test of sweet sorghums.

In legume tests, soy beans and Canada field peas were failures, while mungos produced a fair crop of beans and matured in less time than any other variety. Jack beans and velvet beans made slow growth in the dry season, but responded vigorously in the wet season. Jack beans were the only legumes withstanding the typhoon. Cowpeas gave good results in all cases and on all soil types, with New Era and Whippoorwill appearing well adapted for all purposes. In a forage test in which these varieties were planted broadcast and in drills 3 ft. apart, the drilled plats gave larger yields of peas, but the broadcasted areas gave slightly more forage. This also held true with mungo beans. Cowpeas proved the best cover crop for the long dry season, while velvet beans produced the best growth during the rainy season. Alfalfa was considered unsuited to the climate and environment.

Variety tests of root crops included arrowroot, cassava, sweet potatoes, taro, edible canna, and chufas. In a trial of edible cannas, a yield of 5,525 lbs. of tubers was secured between March and October.

All cotton varieties were killed by the typhoon.

In 10 generations of ear-to-row breeding work with corn, the characters of dwarfness of stalk, one ear, and early maturity have become fairly well fixed, but the yield has apparently decreased.

The maximum yield in fertilizer tests with rice, 2,070 lbs. of first-grade rice and 4.95 tons of straw, was produced by an application of 200 lbs. of ammonium sulphate and 166.5 lbs. of acid phosphate, as compared with 625.5 lbs. of first-grade rice and 4.62 tons of straw, the average of the unfertilized plats. Only the plantings made before October 1 made appreciable crops.

Orinoco tobacco produced 154.3 lbs. of leaves, as compared with 126 lbs. from the native tobacco, and also a larger number of first-grade leaves.

[Report of field crops work in Bengal, 1918–19], R. S. Finlow et al. (*Bengal Dept. Agr. Rpt., 1918–19, pp. 2–6, 7–9, 15–21, 22–25, 26, 27–30, 33–36, 40, 42–47, 50, 52–54, 58, 59, 64, 66, 67, 70–74, 77, 78, 81, 83–85, 86–89, 91, 92, 94–102*).—In continuation of similar work previously noted (E. S. R., 42, p. 132), this report describes variety, cultural, and fertilizer tests with jute, rice, corn, potatoes, sugar cane, tobacco, and miscellaneous field crops conducted at the several experimental centers in Bengal.

[Reports of field crops work in Fiji, 1917 and 1918], C. H. Knowles (*Fiji Dept. Agr. Ann. Rpts., 1917, pp. 3, 4, 5; 1918, pp. 4, 7, 8*).—Results of variety tests with yams, cultural experiments with rice, and field trials of corn, sisal, Mauritius and manila hemp, kapok, kawai (*Dioscorea aculeata*), kava (*Piper methysticum*), cassava, and miscellaneous field crops conducted at the Nasinu Experimental Station during 1917 and 1918 are reported, in continuation of similar work previously noted (E. S. R., 40, p. 231).

[Report of field crops work at the Partabgarh and Benares Agricultural Stations], L. C. SHARMA (*United Provs. Agra and Oudh Agr. Stas. East. Circle, Rpt. 1919, pp. 2–10, 2–5*).—Variety, cultural, rotation, and fertilizer tests with rice, sugar cane, wheat, barley, gram, peanuts, and miscellaneous crops are described in continuation of previous work (E. S. R., 40, p. 825) for the year ended June 30, 1919.

Cultural directions for field crops and vegetables, P. J. WESTER (*Philippine Agr. Rev., 13 (1920), No. 2, pp. 80–88, pls. 7*).—Cultural methods considered best in growing field crops and vegetables in the Philippines are described. Besides the crops commonly cultivated in the temperate regions, directions are presented for the culture of the marutong, patani, seguidilla, and sitao beans, and the adlay, anipay, aroro, apalia, batao, borona, cadios, camote, cassava, chayote, condol, curuba, gabi, guar, libato, nami, patola, pechay, upland ragi, sapang, sembu, sesame, sincama, talinum, tongo, ubi, upo, and yautia.

Handbook of breeding of agricultural plants, C. FRUWIRTH ET AL. (*Handbuch der Landwirtschaftlichen Pflanzenzüchtung. Berlin: Paul Parey, vol. 1, 5. ed., rev., 1920, pp. XVIII+442, pls. 8, figs. 91; vol. 2, 3. ed., rev., 1918, pp. XVI+262, figs. 50; vol. 3, 3. ed., rev., 1919, pp. XVI+240, figs. 45; vol. 4, 3. ed., rev., 1919, pp. XVI+504, figs. 42; vol. 5, 1912, pp. XIX+184, figs. 32*).—This comprises five volumes, of which the fifth has been previously noted (E. S. R., 28, p. 736), as well as earlier editions of the first four volumes, as follows:

I, General Principles for the Breeding of Agricultural Plants (E. S. R., 32, p. 430); II, The Breeding of Corn, Fodder Beets, and Other Root Crops, Oil Seed Plants, and Grasses (E. S. R., 21, p. 543); III, Breeding of Potatoes, Jerusalem Artichokes, Flax, Hemp, Tobacco, Hops, and Leguminous Forage Plants including Clovers (E. S. R., 17, p. 1055); IV, The Breeding of the Four Principal Cereals and Sugar Beets (E. S. R., 24, p. 634).

Trials of exotic cereals in Algeria, L. DUCELLIER (*Bul. Agr. Algérie, Tunisie, Maroc, 2. ser., 26 (1920), No. 10, pp. 218–229*).— Results of tests of varieties of wheat, barley, and oats from European and other sources are reported. The European varieties exhibited a lesser drought and rust resistance, a longer period of winter dormancy, slower plant growth, and later maturity of grain than native African varieties.

Oil plants [in Uruguay], R. S. SILVEIRA (*[Uruguay] Min. Indus. Insp. Nac. Ganadería y Agr. Bol. 37 (1920), pp. 21*).—The culture and utilization of peanuts, sunflowers, sesame, colza, and castor and soy beans in Uruguay are discussed.

A study of the influence of the root system in promoting hardiness in alfalfa, W. SOUTHWORTH (*Sci. Agr., 1 (1921), No. 1, pp. 5–9, figs. 6*).—A résumé of earlier work on the relation of root development to hardiness in alfalfa is presented, together with results of investigations conducted at the Ontario Agricultural College from 1909 to 1912. The author arranges the different root systems of alfalfa plants into three main types: True root system without underground stems, with single or branched taproot; branched taproot with well-defined underground stems; and branched taproot with buds and aerial roots as distinguished from underground stems.

From the observations and investigations it is considered that the capacity of alfalfa to withstand severe winter conditions depends very largely on its root system, plants possessing a branched root system withstanding winter heaving much better than those having only single taproots of whatever length. Those plants with the power to produce rooting underground stems have the ability to renovate themselves, and after the death of the main rootstock, can maintain a separate existence. Alfalfa plants spreading by means of root proliferation possess a form of vegetative multiplication which promises to give the plant greater powers of cold resistence and of recuperation from injury than is possessed by even true rhizomes. This faculty may render possible the growth of good crops under adverse climatic conditions where the culture of common alfalfa would be quite impracticable.

First generation crosses between two alfalfa species, L. R. Waldron (*Jour. Amer. Soc. Agron., 12 (1920), No. 4, pp. 133–143, figs. 4*).—This contribution from the North Dakota Experiment Station compares the amounts of growth made and winter injury sustained by F_1 hybrids between common alfalfa (*Medicago sativa*) and yellow-flowered alfalfa (*M. falcata*) with the growth made and injury sustained by the parent forms. Studies of cross-fertilization occurring between these species have been noted heretofore (E. S. R., 42, p. 32).

The hybrids showed a much greater weight per plant than either *M. sativa* or *M. falcata* plants grown under like conditions. The increase in weight was 47.5 per cent. The absolute variability of the hybrids was much greater than that of the parents. Data on length of stems of the hybrid and the nonhybrid plants did not show significant differences, and the increased weight per plant was considered probably due to the increased number of stems per plant. Although winter injury was comparatively slight, plants of *M. falcata* showed significantly less killing than the other groups.

On the evolution of the corn ear, N. B. Mendiola (*Philippine Agr. Rev., 13 (1920), No. 2, pp. 112–114, pls. 4*).—The author presents and discusses illustrations showing several stages in the transition between the ear and tassel of corn in support of the theory of Montgomery (E. S. R., 17, p. 757) that the ear of corn originated directly from the central spike of some tassel-like structure similar to the corn tassel.

The inequality of reciprocal corn crosses, F. D. Richey (*Jour. Amer. Soc. Agron., 12 (1920), No. 6–7, pp. 185–196, fig. 1*).—In this contribution from the U. S. Department of Agriculture, the yields of three pairs of reciprocal crosses between Boone County White, Fraley Yellow Dent, and U. S. Selection No. 120 are compared, inequality being shown in each pair of crosses. The author observes that a difference in the food materials furnished the young plants by the several maternal parents and a difference in germinal reactions with diverse cytoplasms have been suggested as possible causes of such inequalities, and states that the unequal transmission from Fraley Yellow Dent as a staminate and as a pistillate parent shows that some type of sex-linked inheritance must at least be considered as a possible cause of inequality between reciprocal corn crosses.

Reproducing power of well-filled v. poorly-filled ears of maize, C. P. Hartley and H. S. Garrison (*Amer. Nat., 55 (1921), No. 637, pp. 184–187, fig. 1*).—Tests to determine the effects on the progeny, particularly on productivity, when a stalk of corn is caused to produce comparatively few kernels instead of a normal-sized, well-filled ear are described. Pollination in three different varieties was so controlled as to produce some ears with a few large rounded kernels scattered over the cob, and other ears the butt ends of which were fairly well filled about one-fourth the cob length. Seeds from these lots were compared with those from typical well-filled seed ears matured unmolested in the same rows from similar stalks grown under like conditions.

No differences in growth, height of stalk, or time of silking, tasseling, and maturing were noted among the three lots. With all three varieties the well-filled seed ears produced the highest yields, the increase ranging from 2.2 to 3.9 bu. per acre over the next highest lot. In 25 comparisons between the two lots, the normal seed outyielded the seed from the ears with scattered kernels, its nearest competitor, 16 times, with one tie; and it outyielded the seed from the ears fairly well filled at the butt ends 20 times, with two ties. The ears harvested from each of the three lots of seed were equally well filled and of the same general appearance. These results are held to warrant the conclusions that ears poorly filled by reason of withheld pollination will not transmit this character to their progeny, and can be expected to supply seed almost as productive, if not equally so, as that supplied by ears completely pollinated.

Corn at Holly Springs Branch Experiment Station, C. T. AMES (*Mississippi Sta. Bul. 189 (1920), pp. 8*).—Results of variety trials and fertilizer tests with corn on the brown loam soils are reported, together with information on methods of preparation and cultural practices considered best for grain and silage production on these soils.

Maximum acre yields in 1920 were made by Tennessee Red Cob with 61.1 bu. and Paymaster (Harpeth) 61.6 bu., while in 1919, two prolific varieties, Cockes with 80.4 bu. and Mosby (Woodruff) with 71.2 bu., were leaders. Yields for 40 varieties of corn, grown during different periods from 1912 to 1920, are tabulated.

In fertilizer tests in 1917, the highest yield, 25.8 bu., was secured from an application of 200 lbs. of acid phosphate and 200 lbs. of cottonseed meal, as compared with 15.4 bu. from the adjacent unfertilized check. In 1919 tests, 100 lbs. of sodium nitrate per acre after the first working gave a maximum of 48.2 bu., as compared with 38.1 bu. from the adjacent check. The plat receiving 250 lbs. of cottonseed meal at planting returned 47.3 bu., while corn sown in 6 ft. rows with velvet beans between made 36.7 bu.

Microscopic diagnosis of the cotton species, R. HALLER (*Mikroskopische Diagnostik der Baumwollarten. Wittenberg: A. Ziemsen, 1919, pp. 52, pls. 3*).—Efforts to identify the individual species of cotton in raw fiber and unfinished yarn and textiles are described. The author presents a classification of the species and varieties pertaining to the genus Gossypium, and differentiates the individual species by peculiarities of the leaves, bracts, and seed. The method of procedure and preparation of material are outlined, and observations on each species are set forth in detail. Microphotographs of the upper and lower leaf surfaces and palisade cells of the seed coats of the principal species and varieties studied are included.

Cotton fertilization experiments, 1920, F. H. SMITH and T. S. BUIE (*Georgia Sta. Bul. 137 (1920), pp. 27–36, fig. 1*).—Continuing previous work (E. S. R., 43, p. 136), this describes comparisons of four types of raw phosphates as phosphorus sources for cotton crops on a very fertile soil, second year in cotton; a similar soil sown in peas the previous year; a fairly good soil in alfalfa a number of years previously; and a medium fertile soil, second year in cotton.

No one form of phosphate showed superiority over the others, and no advantage accrued from grinding mineral phosphates to extreme fineness. Ground natural phosphate gave indications that it may furnish phosphorus to the cotton plant during the first season of application and apparently continue to supply phosphorus to the crop the following year. When applied two successive years, natural phosphates produced yields comparing favorably with those from acid phosphate. Natural phosphate treated in a compost heap made better cotton yields than when used untreated. Plats top-dressed with various forms of phosphates gave 26 per cent increase over plats not top-dressed, with acid phosphate producing the greatest gains of the forms used.

Except when mineral phosphates were used with a 0:3:3 fertilizer, cotton yields on a neutral soil were not increased by the addition of 2,000 lbs. of ground limestone. With other fertilizing practices limestone treatment depressed the production of cotton.

Potash additions are not considered essential to cotton production on heavy clay soils of the Piedmont type, as the highest yields of cotton were obtained from 600-lb. applications of 8:3:0 and 8:3:2 fertilizers. Medium clay soil required potash, but the use of higher potash content than that supplied in the 8:3:3 formula was not shown to be advantageous. In the case of the sandy soil, the heaviest application of potash, 8:3:9, gave the best returns, the yields increasing with the amount of potash supplied.

Average yields on a fertile soil for a 5-year period show that the rate of increase in cotton production was greatest for the first 200-lb. application. With the application of complete fertilizers the rate of increase in yield remained constant for additions heavier than 400 lbs. per acre.

[Cotton foliage resists sprays and dust mixtures], H. P. Stuckey (*Georgia Sta. Rpt. 1920, p. 7*).—The use of a large number of spray compounds against the boll weevil on cotton in the active stage of growth showed that cotton foliage possesses a remarkable resistance to sprays and dust mixtures. It is said that almost any standard summer strength spray can be used on cotton with safety.

Cotton varieties, T. S. Buie (*Georgia Sta. Bul. 136 (1920), pp. 15–22*).—In further tests (E. S. R., 41, p. 32; 43, p. 136), College No. 1 and Texas Burr gave the highest amount of seed cotton picked to October 1, and these varieties, together with Piedmont Cleveland, Scott Cleveland, Ezy Muny, and Cook 1214, produced the highest total yields of 25 varieties. Considerable variation was noted in Cleveland, the several strains occupying positions from the second to twenty-fourth in the list. The yields of long staple varieties were near or below the average.

In the period 1917–1920 four strains of Cleveland, Georgia Station, Steinheimer, Piedmont, and Scott, led with average acre yields of 2,018, 1,942, 1,931, and 1,900 lbs. of seed cotton, respectively. In a comparison of the average yields of 1919 and 1920 two years after boll weevil infestation, with those of 1917 and 1918, two years before boll weevil infestation, Piedmont Cleveland remained outstanding with 93.9 per cent of the pre-weevil yield. The average yield of three Cleveland strains under boll weevil conditions was greater than any other variety except King, where the percentage was slightly higher, but the yield considerably less.

Brief notes on wilt-resistant and long staple varieties are included, together with suggestions for cotton culture under boll weevil conditions.

[Breeding of wilt-resistant varieties of cotton in Alabama], H. B. Tisdale (*Alabama Col. Sta. Circ. 44 (1921), pp. 16, 17*).—Leading wilt-resistant varieties of cotton, as determined by tests on wilt-infected land in Alabama, include Cook No. 307–6, Tri-Cook, Toole, Lewis No. 63, and Hybrid No. 189. It appeared that by planting cotton rather thickly on wilt-infected soil and thinning later than usual, the weaker plants die before thinning, thus giving ultimately better stands of cotton than obtained by the usual methods.

Comparative spinning tests of Meade and Sea Island cottons, W. R. Meadows and W. G. Blair (*U. S. Dept. Agr. Bul. 946 (1921), pp. 5*).—Comparative spinning tests of Meade (E. S. R., 40, p. 237) and Sea Island cottons grown during the seasons of 1916–17, 1918–19, and 1919–20 are reported. Grades for 1916–17 and 1918–19 tests were practically equal, while those of 1919–20 were represented by a mixture of Meade grading No. 2½ grown on sandy soil, another mixture of Meade grading No. 3 from clay soil, and a mixture of Sea Island grading No. 1½. The staple was 1⅝ in. for all three seasons, excepting that of the Meade from clay soil which pulled $1\frac{7}{16}$ in.

The averages of the results of the three seasons' tests showed that on the pickers, Meade was 0.82 per cent more wasty than Sea Island; on the cards, 1.4 per cent; and on the combers, 1.94 per cent; making a total of 3.5 per cent.

Comparisons of the breaking strength of Meade and Sea Island yarns for the three seasons revealed a difference of 17.2 lbs. in favor of Sea Island for the 23's yarn and 1.68 lbs. for 100's yarn.

Manila hemp, S. G. WILLIAMS (*Sci. Amer. Mo., 3 (1921), No. 2, pp. 255–257, figs. 8*).—Primitive methods of obtaining fiber from the wild banana plant (abaca) in the Philippines are described and illustrated.

Report of potato investigations, C. F. CLARK (*Colorado Sta. Bul. 261 (1921, pp. 34, figs. 6*).—This is a progress report of potato investigations, including variety trials, seed sources, marketability, running-out, storage and greening studies, and size of seed and irrigation tests. The work was conducted by the U. S. Department of Agriculture at the Colorado Potato Experiment Station at Greeley, in cooperation with the commissioners of Weld County and the station.

Pearl and Rural New Yorker gave the most satisfactory results in variety tests. While Rural New Yorker gave lower yields than Pearl, it produced much smoother tubers and less culls. Green Mountain, Peachblow, and Russet Burbank have given good yields, but they possess various faults unsuiting them to the conditions in the Greeley district. Of the early varieties tested, Early Ohio yielded considerably less than Irish Cobbler and Charles Downing. Irish Cobbler was not apparently suited to the local conditions as the vines showed lack of vigor and the tubers were elongated with very deep eyes.

In four-year tests with Pearl seed the best yields were made by Colorado dry-land seed, followed by Wisconsin and Colorado irrigated seed in the order named. The best yields of Rural New Yorker were obtained from Wisconsin stock, with New York seed following closely. Studies of the relative yields of all varieties in the experiment showed the relatively high quality of Colorado dry-land and Wisconsin seed.

The average storage losses during the years 1915, 1916, and 1918 were 7, 7.8, and 7.6 per cent, respectively, but in 1917 damage from frost injury was held to be the cause of the greater average loss, 9.1 per cent. It is held that the wide variation in losses from different varieties in the given season does not indicate that the extent of the loss may be a varietal characteristic, although losses may be associated with certain relations of the variety to conditions. Of 24,480 lbs. of tubers removed from the field and stored in sacks, 918 lbs., or 3.6 per cent, was dirt, the weight of which constituted about one-half the total shrinkage. Where Rural New Yorker potatoes were stored clean in barrels in a cellar at 40° F. from November 30 to April 3, a loss of only 1.1 per cent was recorded.

In percentage of marketability, Russet Rural, Rural New Yorker, and Green Mountain, with 96.9, 95.7, and 92.2 per cent, respectively, were the leading varieties, while Russet Burbank, with 72.2 per cent, was the lowest.

Rural New Yorker appeared to be very nearly immune to diseases responsible for one form of degeneracy. Excepting new seed, Pearl and Peachblow were badly affected with mosaic disease, which increased in intensity with the length of time that the seed stock was grown at the station, accompanied by a gradual diminution of yield. In comparative tests, pear-shaped tubers of the Rural New Yorker variety, characteristic of a certain form of degeneracy, produced a crop equal in quantity and quality to that produced by the good type of seed tubers, indicating that all pear-shaped tubers are not run out.

Seed spring greened produced somewhat larger returns than ungreened seed in three years' experiments, while fall greened seed gave yields lower than seed not greened.

In time of irrigation tests, early irrigation gave the largest yields in all cases; omission of one application resulted in yields significantly less than the standard check, and large decreases followed the withholding of water until late in the season. Early irrigation resulted in the largest percentage of marketable tubers.

Results of size-of-seed experiments, 1915–1918, showed whole seed to consistently produce better stands, larger total yields, and generally more marketable tubers than cut seed. It also produced a greater number of tubers per hill, which, however, generally averaged smaller in size than those grown from cut seed. Where the seed was subjected to unfavorable conditions during the period of germination a direct relation between the size of seed piece and yield appeared, but this relation was not apparent when conditions were favorable; in fact, deducting from marketable tubers the amount of seed used, the larger sizes were found to be less economical. The results indicate that while the best size may vary with conditions, it should equal or exceed 2 oz. in weight.

First annual report of the Nebraska Potato Improvement Association (*Nebr. Potato Impr. Assoc. Ann. Rpt., 1 (1919), pp. 160, figs. 44*).—This reports the first annual meeting of the association, held at Rushville in November, 1919, and outlines the activities of the association during 1919. Besides the text of the Nebraska potato grading law, the following papers presented at the meeting are included: Soil Moisture Conservation in Dry Land Soils, by L. L. Zook (pp. 25–45); The Colorado Potato Beetle and Its Control, by M. H. Swenk (pp. 49–57); The Work of the Colorado Potato Experiment Station, by W. C. Edmundson (pp. 57–65); Potato Disease Control in Minnesota, by A. G. Tolaas (pp. 73–78); Control of Dry Rot and Fusarium Wilt of Potatoes, by E. M. Wilcox (pp. 79–83); The Seed Potato Industry as Related to Western Nebraska (pp. 83–99), and Potato Experimental and Extension Work of the University of Nebraska (pp. 138–143), both by H. O. Werner; The U. S. Bureau of Markets and Its Relation to the Potato Industry, by W. A. Sherman (pp. 99–105); Trade Channels for Nebraska Potatoes, by C. H. Heard (pp. 108–118); and Why Does the Government Estimate the Potato Crop? by A. E. Anderson (pp. 118–122.)

Relation of flowering time and the position of flowers on the panicle branch to the kernel weight of rice, Y. Yamaguchi (*Ber. Ōhara Inst. Landw. Forsch., 1 (1919), No. 4, pp. 451–517, figs. 35*).—Studies of the relation of the flowering time and the position of the flowers on the panicle branch to the kernel weight of rice are described. The material used in the experiment included typical panicles of the Shinriki, Omachi, Karasu-Mochi, Kazusa-Kobore, and Shima-Nishiki varieties.

In order to clarify the process of study, the division of the flowering sequence of a panicle into the flowering succession of the panicle branches and the flowering succession within the individual branch is suggested. The flowering sequence of the panicle branches proceeds regularly from above downward, while within the individual branches the flowers generally follow the succession: 1, 7, 6, 5, 4, 8, 3, 11, 2, 15, etc.

Concerning the relation between the actual flowering days and the kernel weight, the heaviest kernel in the whole panicle, as well as within the single branch, did not usually develop in the first blooming flower, but in one of the flowers blooming on the second, third, or later days. In general, the earlier the flower bloomed the heavier the grain within developed. The agreement between these qualities was not so large as expected, as the correlation between the observed flowering time and the weight of the glumed or naked kernel was negative and slight. The glume weight, on the contrary, was correlated strongly with the flowering time.

The heaviest glumed or naked kernel, within the panicle branch as well as within the whole panicle, was found usually on the third, fourth, or fifth position on a branch. The heaviest glume, however, was found on the first, fifth, or sixth position. The highest average weight of both glumed and naked kernels on a given position on a branch was situated likewise at the fourth, fifth, and sixth positions. However, the highest average weight of glume on a given position was situated, like the heaviest glume, at the first or fifth and sixth positions.

The sequence of the average weight of a panicle on a given position on a branch usually ran parallel with the average flowering sequence of a panicle branch, and the curves of both agreed better than in the case of the relation between the actual flowering time and the corresponding kernel weight. Contrary to this, most of the curves of the sequence of the average kernel weight of the whole branches and of the flowering sequence for the whole branches did not run parallel. The average kernel weight was usually larger on the lower branches.

The negative correlation between position and kernel weight was generally larger than that between the actual flowering time on a whole panicle and the kernel weight corresponding to this flowering time. This was especially the case with glume weight. A moderate positive correlation between the glume weight and the weight of the naked kernel was observed.

Temporary roots of the sorghums, J. B. Sieglinger (*Jour. Amer. Soc. Agron., 12 (1920), No. 4, pp. 143–145*).—Under conditions in which Kanred wheat and Mexican June corn produced averages of 3.77 and 4.42 temporary roots (including the radicle) per plant, sorghums of the milo-durra, kafir, kaoliang, and broom-corn groups had but one temporary root, the radicle. In the sorghums, the first node develops shortly after germination, and from this node the first permanent roots grow.

The culture of sorghums for forage [in Uruguay], J. Puig y Nattino (*[Uruguay] Min. Indus., Insp. Nac. Ganadería y Agr. Bol. 39 (1920), pp. 82, pl. 1, figs. 19; also in Uruguay Rev. Min. Indus., 8 (1920), No. 54, pp. 279–355, pl. 1, figs. 19*).—Information is presented dealing with the culture, adaptation, feeding, and ensiling of forage sorghums in Uruguay. Considerable agronomic data and analyses of pink kafir, milo, amber sorghum, dwarf broom corn, Sudan grass, and other sorghums are tabulated. The author treats the hydrocyanic acid factor at length, and includes detailed notes regarding the influence of growth periods and meteorological conditions on the presence of this poison. A practical method of determining the amount of hydrocyanic acid in sorghums by the use of Guignard's paper is outlined, together with a chromatic scale of the distinct reactions of hydrocyanic acid when occurring in different intensities.

[Experimental work with sugar cane in Queensland], H. T. Easterby (*[Queensland] Bur. Sugar Expt. Stas. Ann. Rpt., 19 (1919), pp. 37; 20 (1920), pp. 40*).—Continuing work noted heretofore (E. S. R., 40, p. 634), these reports review the progress of the cane-sugar industry in Queensland in 1919 and 1920, present tabulated field and analytical data on new and introduced varieties, and report the result of cultural and fertilizer tests conducted at the sugar experimental stations at Mackay, South Johnstone, and Bundaberg. Tops, middles, and middles and bottoms of Badila cane planted for seed at Bundaberg gave total acre yields of 78.63, 57.23, and 56.68 tons of cane, respectively, from three crops.

Java sugar cane culture, past and present, G. E. G. Vonstietz (*La. Planter, 66 (1921), No. 10, pp. 158, 159*).—A brief historical and economic survey of the development of the sugar industry in Java, together with data on the cost of production.

Sweet potato culture in Missouri, J. T. Rosa, jr. (*Missouri Sta. Circ. 103 (1921), pp. 12, figs. 6*).—A general discussion of practices considered essential to the successful production of sweet potatoes in Missouri.

Results obtained from an extensive test of various commercial fertilizers at Columbia in 1920 did not suggest a special need for commercial fertilizers by sweet potatoes when grown on land of fair fertility in Missouri. In variety tests conducted at Columbia, Strassburg, Red Bermuda, and Southern Queen led, with respective acre yields of 546.7, 489.9, and 461.2 bu., with No. 1 potatoes averaging in weight 16.6, 13.6, and 13.3 oz., respectively. An outstanding result of this test was the relatively low yield of varieties of the Jersey type, and the high percentage of No. 2 or "seed-size" roots in these varieties.

The cost of producing tobacco in Kentucky, W. D. Nicholls and F. W. Peck (*Kentucky Sta. Bul. 229 (1920), pp. 133–190, figs. 12*).—A prelimi[illegible] report of studies of the cost of producing tobacco in Kentucky is presented. The work was in cooperation with the U. S. Department of Agriculture and was conducted on 81 farms in the Burley district, covering 625.5 acres of tobacco, and on 70 farms in the dark tobacco district growing 679 acres. The agricultural and environmental conditions prevalent in the districts are described, and the results of the studies are tabulated and discussed.

In the Burley district the tobacco acreage per farm ranged from 1.2 [illegible] acres, averaging 7.7 acres. Yields per acre ranged from 278 to 2,224 lbs., [illegible] an average of 1,141 lbs. On the farms studied the total cost per acre, [illegible]ing land rent, ranged from $163.06 to $403.18, averaging $289.10. Over one-half of the acreage was produced at between $200 and $300 per acre. The cost per pound varied from 15 to 81 cts., averaging about 26 cts., and with 90 per cent grown at 31 cts. or less. Of the total costs in this district, man labor constituted 42 per cent, land rent 34.3 per cent, barns and sticks 9.6 per cent, horse labor 6.7 per cent, insurance 4 per cent, and machinery and miscellaneous costs amounted to 2.9 per cent.

In the dark tobacco area the tobacco acreage per farm averaged 9.7 acres, with the largest 42 and the smallest 2.5 acres. The highest yield per acre was 1,876 lbs., the lowest 304 lbs., and the average 825 lbs. The total cost per acre ranged from $100.03 to $308.19, averaging $141.76. Over one-half of the acreage was grown at a cost of $125 to $150 per acre. In this area the cost per pound varied from 9 to 38 cts., with an average of 17.2 cts. Over 90 per cent of the tobacco was produced at 23 cts. per pound or less. In this area man labor made up 49.4 per cent of the total cost, land rent 7.8 per cent, horse labor 12.6 per cent, barns and sticks 7.1 per cent, insurance 4.4 per cent, and other items 8.7 per cent.

In both districts when land rent was excluded as a charge, man and horse labor amounted to approximately 75 per cent and the other items 25 per cent of the total cost. In each district the combined operation of stripping and marketing was the principal labor item, with cutting and housing second in the Burley district, and topping, worming, and suckering second in the dark tobacco district.

Wheat varieties of the Sahara, L. Ducellier (*Les Blés du Sahara. Algiers: Govt., 1920, pp. 56, figs. 14; also in Bul. Agr. Algérie, Tunisie, Maroc, 2. ser., 26 (1920), Nos. 6, pp. 97–109, figs. 3; 7, pp. 131–146, figs. 6; 8, pp. 161–170, figs. 2; 9, pp. 185–196, figs. 2*).—The varieties of wheat grown in various regions of the Sahara desert are described and classified, and practices employed in their culture outlined. The future of wheat production in the Sahara desert region is discussed in some detail.

Varieties of wheat tested in New South Wales, J. T. Pridham (*Agr. Gaz. N. S. Wales, 32 (1921), No. 1, pp. 10–19*).—Tabulated information regarding

249 varieties of wheat from different parts of the world tested by the Department of Agriculture of New South Wales is presented. The data include the season, use, class, origin, districts for which suitable, distinguishing characters, good points, and defects of each variety.

Colorado weed seeds, G. E. EGGINTON (*Colorado Sta. Bul. 260 (1921), pp. 91, figs. 164*).—Descriptions and accurate enlarged illustrations of seeds of a large number of weeds arranged by families are presented, together with a descriptive key for the identification of seeds of the principal families of weeds. The occurrence of weed seeds in commercial seed is discussed, and the structure of typical seeds is illustrated and described in detail.

Lawn pennywort, a new weed, A. A. HANSEN (*U. S. Dept. Agr., Dept. Circ. 165 (1921), pp. 6, figs. 3*).—Lawn pennywort (*Hydrocotyle rotundifolia*), introduced from southern Asia as an ornamental, is considered to be a weed particularly undesirable on golf greens and lawns. The plant and its habits of growth and distribution are described and eradication methods indicated. Digging and burning or otherwise destroying the plants and reseeding the lawn after fallowing for at least two weeks is considered the most efficacious method of eradicating the weed. Experiments to eradicate this weed by spraying with solutions of common salt, arsenic, iron sulphate, and gasoline were without success.

HORTICULTURE.

Black's gardening dictionary, edited by E. T. ELLIS (*London: A. & C. Black, Ltd., 1921, pp. XVI+1238, figs. 42*).—A compilation of practical horticultural information prepared for the use of modern English amateur and professional gardeners. The alphabetically arranged subject matter is treated in simple popular style and includes numerous contributions from prominent gardeners and specialists. A garden work calendar is included.

[Report of horticultural investigations in Guam], G. BRIGGS (*Guam Sta. Rpt. 1919, pp. 38–44, fig. 1*).—The horticultural activities for 1919 were largely of a reconstructive nature, due to the devastation caused by a typhoon, July 6, 1919. The plant and propagating houses were completely destroyed and many trees uprooted or otherwise badly damaged. Very little fruit of any kind was produced during the season, though papayas, bananas, pineapples, avocados, and mangoes yielded small crops. A small citrus orchard, consisting of oranges, lemons, limes, and tangerines, was established during the year. The rose apple (*Eugenia jambosa*), introduced in 1910 from the Philippines, produced a good crop of fruit. A list of fruit trees and plants growing at the station is included.

The Cristobal tomato, developed at the station, continues to improve with selection and is considered very promising. A Hawaiian hybrid tomato, introduced during the year, is also of promise. In a variety test, the above tomatoes greatly outyielded other better known kinds.

Experiments with coconuts indicated that clean tillage without fertilizers resulted in a better growth than no tillage and fertilizer. Different methods of copra making were also tested, green nuts showing a shrinkage as high as 72.03 per cent after 11 days' drying, while with ripe nuts it was as low as 26.26 per cent. The best copra was made from nuts that had just sprouted, but fully matured, and well-cured nuts which had fallen to the ground were a close second in yield and gave the best grade of product. Copra cut out of the shell when the nuts were first opened was superior to that allowed to remain in the half shell until loosened by shrinkage. Nuts dried on a bamboo frame raised from the ground about 2 ft. gave a slightly better quality of copra than those left on a mat on the ground.

[Report on horticultural investigations in Illinois] (*Illinois Sta. Rpt. 1920, pp. 20–22*).—In a soil treatment experiment in an apple orchard at Neoga, the plats receiving leguminous cover crop and complete chemical fertilizer ranked highest in production and size of tree. First-year results in a 3-year experiment in methods of planting orchard trees, at Urbana, indicate that moderately pruned trees bear more new growth than severely pruned ones. Fertilization of the roots killed all trees receiving this treatment. Studies with Lima beans indicate that seed inoculation may be an important factor in increasing yield.

The control of garden insect and fungus pests, V. VERMOREL and E. DANTONY (*La Défense de Nos Jardins contre les Insectes et les Parasites. Villefranche-Montpellier: Prog. Agr. et Vitic. [1921], pp. 232, pls. 12, figs. 67*).—A practical treatise, presenting information relative to the more important injurious insects and fungus diseases of fruit and vegetable plants and means for their control. Insecticidal and fungicidal formulas are given, and a spray calendar is included. Twelve colored plates, 10 of insects and 2 of fungi, are appended.

Plant inspection in Missouri, K. C. SULLIVAN (*Missouri Sta. Circ. 101 (1920), pp. 16, figs. 5*).—A review of the activities of the Plant Inspection Service of Missouri from its inception in 1913 through 1920.

In 1920 approximately 100 plant nurseries were inspected, a careful but fruitless search was conducted for the European corn borer, and sweet potatoes and sweet potato slips leaving Missouri were inspected. A note is made of certain menacing insects and diseases not yet present in the State.

Seed growing on eastern Long Island, L. ALLEN (*Conn. Veg. Growers' Assoc. Rpt., 1919, pp. 5–12, figs. 2*).—A popular discussion of the author's methods of growing seed of cabbage, kale, Brussels sprouts, and spinach.

Pomological progress in New Brunswick, A. G. TURNEY (*Sci. Agr., 1 (1921), No. 4, pp. 175–177*).—The development of fruit growing in the Province of New Brunswick is discussed, and the origin of Sharp's New Brunswick, Woodstock Bloom, Munro Sweet No. 1, Walden, and Crimson Beauty apples is noted.

Reports of the Fruit Experiment Station, Shillong, for the nine months ending March 31, 1919, and the year ending March 31, 1920, C. H. HOLDER (*Assam Dept. Agr. Expts. Rpts., 1919, pp. 45–73; 1920, pp. 46–75*).—Records are given of the varieties of orchard and small fruits on trial at the station, with brief notes on their behavior during the periods. Several well-known American varieties are included; the majority, however, are of European origin.

Reports of the director of fruit culture, A. H. BENSON (*Queensland Dept. Agr. and Stock, Ann. Rpts., 1918–19, pp. 50–54, pls. 3; 1919–20, pp. 47–53, pl. 1*).—Notes are given on bananas, pineapples, citrus fruits, custard apples, mangoes, grapes, deciduous fruits and vegetables. Tables showing the exports and imports of horticultural products for the respective years are included.

How to prune small fruits, J. G. MOORE (*Wis. Agr. Col. Ext. Circ. 134 (1921), pp. 8, figs. 3*).—Popular instructions are given for pruning the grape, raspberry, blackberry, currant, and gooseberry.

Spring spraying program for 1921, A. FRANK (*Washington Sta., West Wash. Sta. Mo. Bul., 8 (1921), No. 12, pp. 182–186*).—A spraying program is outlined for apples and pears. The more common disease and insect pests of the apple, pear, peach, plum, and cherry are considered separately and specific remedies for each given.

Spraying and dusting, G. E. SANDERS (*Marit. Farmer and Coop. Dairyman, 26 (1921), No. 11, pp. 294, 295, 314, 315*).—In this address, presented before the

Nova Scotia Fruit Growers' Association, at Windsor, N. S., the present status of dusting in apple orchards is discussed. The history and development of the more common spray materials for apples are reviewed.

Experiments with various dust mixtures in an orchard at Berwick, N. S., in 1920, indicate that copper arsenic dust, in the proportion of 4 per cent metallic copper and 1.25 per cent metallic arsenic, is superior to the sulphur lead arsenate mixture, both in disease and insect control. Copper arsenic dusted trees yielded 57.5 per cent No. 1 fruit, sulphur lead arsenate 34 per cent, check 19.2 per cent. Time of application experiments showed invariably that early morning dusting is preferable, particularly for scab control. The mixture of lead arsenate and sulphur proved more effective than straight sulphur in disease control.

A dust calendar is included.

Arsenical and mixed sprays for fruits, P. MARCHAL (*Min. Agr. [France], Ann. Serv. Épiphyties, 6 (1918), pp. 242–280*).—A compilation of information on the spraying of fruit trees with arsenicals, singly or in combination with other materials. The subject is treated under four general headings, (1) the treatment of fruit trees in America, (2) the treatment of fruit trees in France, (3) the relation of arsenical treatments to health, and (4) experiences of 1917. A fairly complete bibliography is included.

Studies on the Amygdalaceae and pome fruits of cold portions of Indo-China and South China, A. CHEVALIER (*Compt. Rend. Acad. Sci. [Paris], 170 (1920), No. 19, pp. 1127–1129*).—This includes an account of the peach, almond, prune, apricot, cherry, apple, and pear as cultivated in high portions of Asia.

Quince (*Agr. Jour. Egypt, 9 (1919), pp. 129, 130, pl. 1*).—A varietal study of quinces at Giza, Cairo, indicated the value of Rea Mammoth.

Horticulture, J. F. DUGGAR (*Alabama Col. Sta. Circ. 44 (1921), pp. 8, 9*).—The value of nitrate of soda as a factor in increasing the yield of Satsuma orange trees and in restoring a freeze-injured orange orchard to a productive condition is noted.

Growing annual flowering plants, L. C. CORBETT and F. L. MULFORD (*U. S. Dept. Agr., Farmers' Bul. 1171 (1921), pp. 83, figs. 66*).—A contribution from the Bureau of Plant Industry containing popular information on the use, propagation and culture of annual flowering plants. The plants are grouped according to height at maturity. A list of plants suitable for special environmental conditions, and a table showing the principal characteristics of many annual plants, are included.

Wild flowers of New York, H. D. HOUSE (*N. Y. State Univ., State Mus. Mem. 15 (1918), pts. 1, pp. 185, pls. 143, figs. 114; 2, pp. 186–362, pls. 121, figs. 16*).—A two-part memoir devoted to the wild flowers of New York State. The text is made up of simple botanical descriptions, accompanied by several hundred remarkable color illustrations of many of the species. Indexes to illustrations and subject matter are included in the second volume.

FORESTRY.

Conifers and their characteristics, C. COLTMAN-ROGERS (*London: John Murray, 1920, pp. XIII+333, pls. 4, figs. 5*).—A popular treatise on the coniferous family, in which the trees are arranged according to botanical classification and the distinguishing characteristics of each species are pointed out. Many observations of an historical and literary nature are included. A series of identifying tables, containing brief technical descriptions of the many species, is appended.

The morphology of wood in relation to brashness, C. C. Forsaith (*Jour. Forestry, 19 (1921), No. 3, pp. 237–249, pls. 2*).—A contribution from the New York State College of Forestry, Syracuse University, relating to the causes of brashness (brittleness) in the woods of bald cypress, tulip poplar, and white ash. Determinations of specific gravity, percentages of ray tissue and summer wood, and microscopic measurements of the tracheids of strong and brash wood of the three species are presented in tabular form.

"Brashness is increased by a decrease in the amount of summer wood, by a decrease in the thickness of the tracheid or fiber wall, by a decrease in the volume of the fibers, by an increase in the volume of the wood rays and storage parenchyma, and by an increase in the number and size of the bordered pits. In the conifers the proportion of thick-walled summer tracheid and thin-walled spring tracheids determines strength or weakness except as this may be influenced by the rays, resin canals, and storage parenchyma. In the diffuse-porous woods the percentage of fibers, the thickness of their walls, and the volume of the rays and vessels bear a like relation to resistance. In the ring-porous woods there is added a new feature, the width of the specialized summer area. This area (the spring increment being constant) increases the tendency to brashness as it decreases in amount.

"Failure in wood either due to flexure or compression is directed by the vessels and rays. The fibers, the last to give way, break horizontally, split in the thin-walled cells, or separate along the middle lamella in the thick-walled type. Separation at the ends is uncommon.

"Variations in the specific gravity are quite closely proportional to variations in the volume of the fibers and the thickness of the lignified walls, and less frequently inversely proportional to the volume of the vessels and rays. Fiber length varies independently of variations in specific gravity, and cell size is more or less constant without regard to weight. The length of the fibers is not important in determining brashness."

Further notes on intercellular canals in dicotyledonous woods, S. J. Record (*Jour. Forestry, 19 (1921), No. 3, pp. 255–266*).—A second report (E. S. R., 39, p. 145), in which data on many additional woods are presented. A list of families of dicotyledons in which intercellular canals have been found is included. Twenty-seven references to literature are cited.

A plea for recognition of artificial works in forest erosion control policy, A. Leopold (*Jour. Forestry, 19 (1921), No. 3, pp. 267–273*).—The author discusses the factors which lead to the erosion of forest lands, particularly stream valleys and sodded open uplands, and points out the necessity of supplementing a proper system of grazing control by artificial control works, such as crude dams, tree planting, etc.

DISEASES OF PLANTS.

Notes on weeds and plant diseases [Colorado], W. L. May and J. G. Leach (*Colo. State Ent. Circ. 28 (1920), pp. 40–46, pl. 1, fig. 1*).—Following a report by May on phases of the whorled milkweed problem in Colorado, Leach gives a brief, systematic account of the barberry eradication campaign as conducted in cooperation with the Bureau of Plant Industry, U. S. Department of Agriculture, and the Colorado Agricultural College, including the results of the year's work and an outline of plans; also a brief report on the canker of poplar and willow, which has proved to be very prevalent and destructive throughout the southern half of Colorado. This disease is evidenced by cankers formed on the branches and trunks of the trees affected. Infection usually takes place through injuries. The disease is caused by the fungus *Cytospora chrysosperma*, which is characterized by the bright red exudate which it forms on the surface of the diseased bark.

Recommendations for control of the disease include selection of resistant species, protection, abundant water, strict supervision of nursery stock, and destruction of all material known to be infected.

[Plant disease investigations of the Georgia Station] (*Georgia Sta. Rpt. 1920, pp. 4, 5*).—It is claimed that field and greenhouse experiments have shown that the mosaic disease of peppers is distinct from a similar disease of the wild pokeweed, and that pepper mosaic is not soil transmitted. Other experiments are said to indicate that among both fruits and vegetables are strains resistant to the root-knot nematode, and this fact is taken as the basis for studies on factors underlying such resistance.

Studies were made of spermatia of the higher Ascomycetes, and the complete life histories of eight species have been worked out. The results are said to indicate that the occurrence of spermatia is quite general in many groups of Ascomycetes, that they occur in conjunction with the early development of ascocarps, and that they are not propagative structures but seem to be sexual elements associated with the development of the ascus.

A brief report is given of some investigations on the Fusarium wilt of tomatoes in which it is stated that infection occurs most commonly through any of the softer tissues of the plant, but that the fungus is not able to penetrate mature cells if the walls are at all thickened. Tests were made of the wilt resistance of wild tomatoes from tropical America, and none of the five varieties showed any immunity to disease.

Field tests are reported upon for the control of tobacco root rot through soil disinfection with calcium hypochlorite and formaldehyde, in which it was found that calcium hypochlorite gave no beneficial results and that formalin seemed promising, though its use seems prohibited on account of the expense.

Notes are given of pepper diseases due to Alternaria and Gloeosporium. Both of these fungi are able to attack young green fruits, and observations made in the field are said to indicate that defoliation of the plants by leaf-spot diseases is an important factor in causing sun scald and decay of fruits.

Plant diseases [Bermuda], E. J. WORTLEY (*Bermuda Bd. Agr. Rpt., 1916–1918, p. 26*).—Warm, moist southwest winds render local control of plant diseases difficult in Bermuda, especially as these conditions are often accompanied by washing rains which reduce the effectiveness of sprays.

Potato late blight (*Phytophthora infestans*) was very prevalent in 1918, causing much loss from the shipping of diseased potatoes. Early blight (*Macrosporium solani*) causes much damage in November and December.

Onions have suffered no serious outbreak of *Peronospora schleideniana* since 1914.

Beets often show *Cercospora beticola*, but seldom suffer severely from that fungus.

A serious cabbage disease noted in 1918 proved to be due to *Pseudomonas campestris*.

Celery losses have been serious during recent years from *Septoria petroselini*, but less so from *Cercospora apii*. Black heart (bacterial?) is the most serious celery disease in the colony.

Tomato interests are seriously affected by *S. lycopersici*, though removal of lower leaves and spraying with Bordeaux mixture checks that disease. *M. solani* has also been troublesome. *Cladosporium fulvum* is seldom seen.

Lettuce drop wilt (*Sclerotinia libertiana*) occasionally causes complete destruction of patches of lettuce. Leaf spot, due to an unknown organism, has been troublesome.

Annual report for 1919 of the botanist [on crop management and diseases], R. H. Biffen (*Jour. Roy. Agr. Soc. England, 80 (1919), pp. 407–411*).—While crop diseases were not particularly prevalent during the period covered by this report, wheat black rust caused considerable damage in certain districts, and potato wart disease showed in one locality. Immune varieties are discussed. Potato blackleg was noted on four occasions. Skin-spot was associated with cases of failure to sprout satisfactorily. Blight was less severe than usual. Alfalfa crown gall has become very common. Fruit fungus pests reported include peach leaf curl and mildew, apple and gooseberry mildews, apple brown rot and scab, and Botrytis on cherry. Silver leaf was noted on the Czar variety of plum. Apple glassy disease affected the two varieties Allington Pippin and Margil.

Mycology, F. J. F. Shaw (*India Bd. Sci. Advice Ann. Rpt., 1917–18, pp. 35–40*).—This report presents results of a study of ufra of rice (*Tylenchus angustus*), in which it is said that the nematode can be carried over by the seed from an infected crop. Movement of the organism from the water to the upper portions of the plant is favorably influenced by humidity (95 per cent), high temperatures, and light. Black band (*Diplodia corchori*) of jute (*Corchorus capsularis*) was discovered in different places. Black thread and leaf fall of rubber are decreased, but not economically, by removal of seeds and pruning for free admission of light and air.

Root rot of apple is caused by a Rosellinia, which is more severe in strongly acid soils. Cracking of apple fruits due to *Coniothecium chomatosporum* is very common in places. The advantage of spraying for peach leaf curl has been demonstrated. Die-back of chillies due to *Vermicularia capsici* is checked by spraying, also by late sowing on highly manured land. A blossom and twig rot is due to a fungus not previously known in India, *Choanephora cucurbitarum*. Root rot of sal causes few deaths as compared with the number of new attacks observed. Rangoon bean is severely damaged by a sclerotial fungus. *Erysiphe polygoni* is said to cause a serious disease of poppy. Peanut was attacked with unusual severity by a Cercospora (not *C. personata*).

It is shown that all parts above ground of *Hevea brasiliensis* may be attacked by *Phytophthora meadii*, which is considered different from *P. faberi*.

Paddy blast due to *Piricularia oryzae* has been found in one district. Smut (*Ustilago crameri*) on *Setaria italica* has been studied, and found to yield to a 0.5 per cent solution of copper sulphate. Tea brown blight (*Colletotrichum camelliae*) has been studied, and work on root disease of areca palms (*Fomes lucidus*) and the stamping out of koleroga (*Phytophthora arecae*) has been successfully continued. An account is noted of coffee black rot (*Corticium koleroga*).

[Studies on plant diseases] (*Mitt. Biol. Reichsant. Land u. Forstw. No. 17 (1919), pp. 6–17, figs. 2*).—Condensed accounts are given of tests and other studies regarding seed treatments for wheat stinking smut; breeding tests looking to the control of potato canker; *Coprinus* sp. on beet seed; and potato leaf roll.

Respiration of plants parasitized by fungi, G. Nicolas (*Compt. Rend. Acad. Sci. [Paris], 170 (1920), No. 12, pp. 750–752*).—As a result of work following up that previously noted (E. S. R., 30, p. 453) by employing methods like those of Maquenne and Demoussy (E. S. R., 31, p. 33), the author reports that intensity of respiratory activity in parasitized as compared with that in nonparasitized plants was increased in case of endophytic and decreased in case of ectophytic parasites. The respiratory quotient of parasitized organs may be equal to or greater than that of nonparasitized organs.

The breeding of disease-resistant varieties of cultivated plants, E. Molz (*Ztschr. Pflanzenzücht., 5 (1917), No. 2, pp. 121–244, figs. 6*).—An extended account with discussion is given of observation and experimentation on the development and loss of resistance, of hybridization in relation to resistance, and of adaptation to hosts by parasitic organisms.

The action of rain on deposits from copper sprays, Mr. and Mrs. G. Villedieu (*Compt. Rend. Acad. Sci. [Paris], 171 (1920), No. 6, pp. 360–363*).—This is the first part of a project regarding the influence of rainfall on the retention and properties (effects) of fungicides employed in connection with plant disease.

The nontoxicity of copper for fungi, particularly downy mildew, Mr. and Mrs. G. Villedieu (*Compt. Rend. Acad. Sci. [Paris], 171 (1920), No. 16, pp. 737–739*).—Details of studies following those noted above are presented to show that copper is not more toxic to the Peronosporaceae than to other fungi. It appears possible to replace this metal in anticryptogamic sprays by one more readily obtainable.

Cereal smut and stripe disease, F. Aumüller (*Deut. Landw. Presse, 47 (1920), No. 54, pp. 383, 384*).—This is a statistical study of susceptibility or resistance as related to species and variety in cereals to smut and to stripe disease (*Helminthosporium gramineum*), and of effective concentrations in different fungicides appropriate to their control.

Barley stripe as a varietal disease, L. Kiessling (*Fühling's Landw. Ztg., 65 (1916), No. 23–24, pp. 537–549*).—This is a study of barley varieties, weather, and other factors in relation to stripe (*Helminthosporium gramineum*) and its control.

Varietal susceptibility of barley to stripe disease, L. Kiessling (*Ztschr. Pflanzenzücht., 5 (1917), No. 1, pp. 31–40*).—The results are tabulated with discussion of variety tests of barley as regards susceptibility to stripe disease (*Helminthosporium gramineum, Pleospora trichostoma*).

Oat anthracnose, W. Schikorra (*Centbl. Bakt. [etc.], 2. Abt., 45 (1916), No. 18–25, pp. 578–586*).—Discussion is given of data regarding the relation of oat dry spot to soils, including reactions and fertilizers.

Flag smut of wheat, V. A. Putterill (*Union So. Africa, Dept. Agr. Jour., 1 (1920), No. 3, pp. 252–257, figs. 5*).—A general account of flag smut (*Urocystis tritici*) concludes with the statement that unless properly controlled it may become a very serious pest in South Africa.

How Iowa fights the injurious barberry, L. L. Rhodes (*Iowa Agr., 21 (1920), No. 2, pp. 65, 84, 86, 88, fig. 1*).—This contains a sketch of the history of the common barberry passing from Asia through Europe to America and spreading in portions of this country until knowledge of its connection with wheat rust (*Puccinia graminis*) led to the eradication campaign now in progress. Only three harmful species of barberry are known to exist in Iowa. These are the Amur barberry (*Berberis amurensis*), the common green leaf (*B. vulgaris*), and the purple leaf variety (*B. atro-purpurea*).

The results of estimates at six Iowa centers in 1919 give an average wheat crop loss of 5 per cent over the State of Iowa. Eradication methods are noted.

Treat seed grain, R. E. Vaughan and A. G. Johnson (*Wis. Agr. Col. Ext. Circ. 133 (1921), pp. 9, figs. 4*).—Directions are given for the treatment of seed grain for the prevention of smut, the methods suggested being those found by the Wisconsin Experiment Station to be satisfactory. The use of formaldehyde is recommended, and the two-hour soaking method has been found best for barley, proving successful for the control of stripe and covered smut of barley and greatly reducing loose smut. Five-minute soaking has proved best for oats, wheat, and rye. Where barrels or tanks are not available, sprinkling the grain or applying a more concentrated solution of formaldehyde with a sprayer may be employed. Smut treating machines are on the market and it is stated that many of them are proving quite satisfactory.

Bean anthracnose, W. Fischer (*Fühling's Landw. Ztg., 68 (1919), No. 13–14, pp. 241–259*).—The author notes a study of bean anthracnose (*Gloeosporium lindemuthianum*) and of control measures attempted, including varietal and breeding tests.

Control of cruciferous club root, H. Müller-Thurgau and A. Osterwalder (*Landw. Jahrb. Schweiz., 33 (1919), No. 1, pp. 1–22, figs. 7*).—An account of tests with different substances suggested for control of cruciferous club root (*Plasmodiophora brassicae*) shows very high effectiveness in case of Steiner's mixture and calcium hydrate, but lower effectiveness or none for several other preparations.

A study of the black and the yellow molds of ear corn, J. J. Taubenhaus (*Texas Sta. Bul. 270 (1920), pp. 3–38, figs. 10*).—The author presents the results of four years' study of the black and yellow molds of ear corn due to *Aspergillus niger* and *A. flavus*. The black mold is said to attack corn wherever openings have been made through the husk by the corn earworm, while the yellow mold in the field seldom invades more than one-third or less of the tip of the ear, and it is nearly always found on varieties with erect ears, which catch and hold water from rain or dew.

Inoculation experiments with the black mold on a large number of different host plants are considered to indicate that there are no physiological species or strains of *A. nigra*.

The author recommends the elimination of insect injury for the control of the black mold, and the planting of varieties of corn having pendant ears for the control of the yellow mold.

Both of these molds are also said to attack broom corn, and selections made at the station have shown that broom corn in which the length of the peduncle had been increased was less subject to the disease. These strains have also resulted in a better quality of broom corn.

Maize smut, E. Noffray (*Jour. Agr. Prat., n. ser., 33 (1920), No. 20, pp. 367–369, figs. 2*).—A general account is given regarding propagation, transmission, development, and control of maize smut (*Ustilago maydis*) in the three kinds of maize commonly cultivated in France.

Controlling flax wilt by seed selection, E. C. Stakman, H. K. Hayes, O. S. Aamodt, and J. G. Leach (*Jour. Amer. Soc. Agron., 2 (1919), No. 7, pp. 291–298, pl. 1*).—Reporting work begun in 1911, the authors state that it is possible by careful selection (preferably by the undivided plant method, which gives a more uniform product) to produce good crops of flax on heavily infected flax-sick soil. A seed-plat method is discussed as preferable. It is thought possible, by extensive adoption of plans discussed, to restore flax production eventually to the normal rate.

Susceptibility of Phaseolus vulgaris and P. multiflorus, G. Lakon (*Ztschr. Pflanzenkrank., 26 (1916), No. 2, pp. 83–97, figs. 5*).—An account is given of conditions, features, and effects of infection of *P. vulgaris* and *P. multiflorus* by *Uromyces appendiculatus* and other fungi, with a discussion of varietal differences and resistance.

Potato diseases in New Jersey, M. T. Cook and W. H. Martin (*New Jersey Stas. Circ. 122 (1921), pp. 39, figs. 22*).—Descriptions are given of the various diseases of potatoes which have been observed in New Jersey, with suggestions for their control so far as definite means are known. A report is given of spraying experiments which have been carried on for a number of years, the results indicating that spraying is advantageous whether there is a heavy infestation of disease or not. For the control of the scab and scurf, the author recommends seed treatment with corrosive sublimate or formaldehyde solution. In connection with the scab control, it is recommended that sulphur be applied to the soil to increase the acidity. Where a large proportion of the previous crop was rendered unsalable due to scab, the application of sulphur should be made at the rate of from 500 to 600 lbs. per acre. Where a less amount of scab is present, the application of sulphur should be reduced.

[Potato diseases], R. SCHANDER (*Fühling's Landw. Ztg., 67 (1918), No. 11–12, pp. 204–226, fig. 1*).—The author notes a study of the development of potatoes and of their diseases during the summer of 1917, in Posen and West Prussia as influenced by the unfavorable weather conditions then prevalent.

Report of professor of botany [Nova Scotia Agricultural College], H. W. SMITH (*Nova Scotia Sec. Agr. Ann. Rpt., 1919, pt. 1, pp. 63–66*).—The author states that large potatoes appear to be more frequently affected by late blight than are small tubers. Selection of small tubers for seed in the main crop caused no increase in the production of small tubers, though another experiment carried on for three years showed that selection of tubers weighing only 1 oz. as compared with tubers weighing 2 oz. gave a smaller yield each year.

Apparently potato scab in crops raised on infected areas was lessened by planting the seed tubers in soil treated with sulphuric acid or hydrochloric acid. The same was true in case of soil treated with swamp muck and acid phosphate.

Potatoes planted in ground on which straw had been burned were delayed 10 days in appearing above ground, but the yield was not decreased.

Degeneracy in potato, E. FOEX (*Jour. Agr. Prat., n. ser., 33 (1920), Nos. 16, pp. 275–279; 18, pp. 326–329; 19, pp. 344–346; 20, pp. 365–367*).—An account is given of the various agencies (diseases) associated with forms of degeneracy, chiefly in potato in different countries, as France, Holland, and the United States.

Potato wart disease in Britain, T. ANDERSON (*Potato Mag., 2 (1920), No. 8, pp. 8, 9, figs. 2*).—This is intended to be a brief but authoritative statement regarding potato-wart disease, as appearing at several points in Pennsylvania and at Thomas, a coal mining town, and Whitmer, a lumber camp, both in West Virginia. An account is given of the nature, spread, and control of the disease. Immune varieties are known in Great Britain, some of these being old established favorites.

Wart disease of potatoes (*Potato Mag., 2 (1920), No. 8, pp. 9–11, 34, figs. 4*).—This is Leaflet No. 11 of the Board of Agriculture for Scotland dealing with potato wart disease (*Synchytrium endobioticum*), which is said to be practically confined for the present to small private gardens and allotments. Discussion is given of the distinguishing features of the disease, its life history, and such practical considerations as precautionary and preventive measures and management of infected soil. The duration of infection when once established is not known.

Diseases, insects, and plant pests of the sugar cane in the Philippine Islands, C. W. HINES (*Philippine Agr. Rev., 11 (1918), No. 4, pp. 275–277, pls. 3*).—An account is given of observations on the Philippine pests and diseases of sugar cane, including insect and plant parasites.

Preliminary report on the spread of [sugar cane] gummosis, F. LEDEBOER (*Arch. Suikerindus. Nederland. Indië, 27 (1919), No. 18, pp. 956–961*).—The most important outcome of the comparative studies here outlined is said to be the proofs obtained that sugar cane gummosis is readily transmitted by the knife from diseased plants to sound cuttings.

The mosaic disease of sugar cane in Mississippi in 1920, L. E. Miles (*Mississippi Sta. Bul. 191 (1920), pp. 3–11, fig. 1*).—The sugar cane mosaic disease is said to have been found at only one point in Mississippi in 1919, but a survey of the State made in 1920 showed 34 properties located in 14 different counties to be infected with the mosaic disease. The location of the properties and percentage of infection are indicated.

For the control of this trouble the author recommends the roguing of the fields where mosaic disease occurs to the extent of 20 per cent or less. When a greater amount of infection is present, the grinding of the cane, destroying of all the refuse, and plowing up and destroying of the stubble are suggested, the ground to be planted during the next season to some crop not susceptible to this disease.

Sour rot in sugar cane cuttings, C. A. H. von Wolzogen Kühr (*Arch. Suikerindus. Nederland. Indië, 28 (1920), No. 19, pp. 703–756, pls. 17, figs. 7; also Meded. Proefstat. Java-Suikerindus., Landbouwk. Ser., No. 3 (1920), pp. 54, pls. 17, figs. 7*).—Sour rot of cane cuttings, as here dealt with, is said to afford a starting point for the bacterial infection of the growing plant. The author points out the importance of starting with sound cuttings and favorable soil conditions to insure rapid growth.

The yellow-stripe [cane] disease, N. Deerr (*Facts About Sugar, 10 (1920), Nos. 10, pp. 190, 191; 11, pp. 210, 211; 12, pp. 232, 233*).—These installments constitute the author's report on the prevalence and nature of sugar cane yellow-stripe disease in Porto Rico, based on a first-hand survey which was made during December, 1919, and January, 1920, of conditions prevailing over a great part of the cane areas in Porto Rico. The account deals briefly with the history of the disease, the reasons for the difference between its behavior in Porto Rico and that in Java and Hawaii, the influence of precipitation, the clear differentiation between yellow stripe and the chlorosis due to root disease, and preliminary studies by Metz regarding the causation of yellow stripe.

The yellow-stripe disease appears to have been introduced from Argentina in 1914 on Japanese cane seedlings brought by way of Egypt, where the disease is now known to be prevalent. In parts of Porto Rico it has shown a high degree of virulence and has become fully established in nearly every part of the island. No significant relation was established between the disease and rainfall, ratooning, or root disease chlorosis, and evidence is referred to as recently obtained to the effect that the yellow-stripe disease in Porto Rico is due to an organism.

Apparently a considerable feature of the difficulty in control is the supposed occurrence of secondary infection, or the appearance of the disease in cane supposedly free from disease. Soil infection appears to have been eliminated from the probable causes. The agency of other hosts is suspected from the failure of control by rotations.

Control measures briefly discussed include seed selection, roguing, decrease of ratoonage, intermediate crops, destruction of rubbish, spraying, and the use of immune varieties, among which Kavangire (Uba)receives favorable mention.

Sugar cane stripe disease [in Java], P. van Harreveld (*Arch. Suikerindus. Nederland. Indië, 27 (1919), No. 18, pp. 919–922*).—Sugar cane stripe disease is said to have shown unusual prevalence early in the season, this being true even in case of varieties usually showing low percentages of attack. The causal agent is not known.

Diseases of the sweet potato in Mississippi and their control, D. C. Neal (*Mississippi Sta. Bul. 190 (1920), pp. 16, figs. 14*).—Descriptions are given of the diseases of sweet potatoes occurring in the field and also the storage rots as observed in Mississippi, with suggestions for their control. In connection with the control of storage rots, the elimination of field diseases by control methods is recommended and it is suggested that potatoes be dug before frost, thoroughly dried, cured, and stored at suitable temperatures.

Tomato wilt, J. A. McClintock (*Georgia Sta. Bul. 138 (1920), pp. 37–49, figs. 5*).—The author reports tomato wilt, due to *Fusarium lycopersici*, widely spread in the coastal plain soils and becoming more serious in the Piedmont section of the State each year. The plants are generally of considerable size and are setting fruit when the first symptoms of the disease are manifest, and they usually die within a few weeks after the lower leaves begin to wilt. Attempts have been made by different investigators to develop strains of tomatoes resistant to wilt, but those adapted to one section of the country have not always proved adapted to other regions.

The author describes a method of growing tomato plants in containers of uninfested soil which it is thought may prove practicable for the home gardener who desires to raise only a few plants. The sterilization of the soil is effected by pouring boiling water through the containers at the rate of 7 gal. of water per cubic foot of soil. Investigations are said to have shown that the tomato wilt is not due to the same fungus which causes wilts of cotton, cowpeas, okra, and watermelons.

Brown [or black] rot in apples, H. Wormald (*Fruit, Flower, and Veg. Trades' Jour. [London], 38 (1920), No. 11, pp. 289, 291*).—The author instances the rapidity of growth of brown rot (*Monilia fructigena*) in apples as noted at Wye College in the summer of 1917, with a discussion of methods of overwintering and of control measures. An account is also given of stored apples affected with this fungus, which may show a black rot under certain conditions. The precise conditions producing brown rot in some cases and black rot in others have not been determined.

Brown rot of apricots and its prevention, W. L. Howard (*Better Fruit, 15 (1920), No. 1, p. 7*).—Apricot brown rot is said to have increased rapidly in California during the past five or six years, especially in the San Francisco Bay region and the coastal valleys. This disease does its chief damage in this region by attacking the flower clusters, then quickly killing the fruit spurs, and sometimes spreading to the wood, usually not over two years old. The disease may attack apricots and prunes when fully grown or nearly ripe. The chief protection, locally, against this disease is the dryness of June and early July. Peaches are protected in the same way during July and August, particularly in the interior valleys. Cold, wet weather at blooming time favors attack, as does also lowness of situation with attendant likelihood of frost injury.

As the result of trials with 17 or 18 different spray treatments at the Deciduous Fruit Station established in January, 1920, by the University of California at Mountain View in the Santa Clara Valley, it is believed that a single winter spraying with lime sulphur at winter strength, that is, 1 gal. of lime sulphur to 9 gal. of water, will control the disease, if given just as the trees are coming into bloom. Dry lime sulphur 12 lbs. in 50 gal. of water also gives good results. Bordeaux mixture at 4:5:50 was also effective. Other protective measures are briefly discussed.

Differences in Monilia cinerea on sweet and on sour cherries, K. Killian (*Jahresber. Ver. Angew. Bot., 15 (1917), No. 2, pp. 158–160, figs. 2*).—A study of *M. cinerea* on sweet and sour cherries and on other media is very briefly outlined.

The spraying of stone fruit orchards in the Cape Province, with special attention to red spider, F. W. Petty (*So. African Fruit Grower and Smallhold., 7 (1920), No. 10, pp. 303, 305*).—The most common diseases in the Western

Province are said to be leaf curl and rust of peach and shot-hole fungus disease of plum. These are described, as are also injuries due to insects in connection with treatments which are outlined.

Cranberry diseases and their control, C. L. Shear (*U. S. Dept. Agr., Farmers' Bul. 1031* (*1920*), *pp. 22, figs. 13*).—Popular descriptions are given of the more common diseases of the cranberry, with suggestions for their control. Most of the fungus diseases, it is stated, can be prevented to a considerable extent by spraying with Bordeaux mixture. Among the diseases described are early rot (*Guignardia vaccinii*), bitter rot (*Glomerella cingulata vaccinii*), end rot (*Fusicoccum putrefaciens*), blotch rot (*Acanthorynchus vaccinii*), hard rot and tip blight (*Sclerotinia oxycocci*), red gall (*Synchytrium vaccinii*), rose bloom (*Exobasidium oxycocci*), red leaf spot (*Exobasidium vaccinii*), false blossom, black rot (*Ceuthospora lunata*), and rust (*Pucciniastrum myrtilli*).

Suggestions are given for the control of rot and spoilage during storage, shipping, and marketing. Proper methods and conditions of picking, storing, and handling of fruits, it is claimed, will largely control the storage rots. A description is given of a form of power sprayer that has been developed for the spraying of cranberry bushes.

Anthracnose or zwart roest of the grape, I. B. P. Evans (*So. African Fruit Grower and Smallhold.*, *7* (*1920*), *No. 8, p. 219, figs. 2*).—One of the most common and destructive diseases of grape in South Africa is that called anthracnose or zwart roest (*Gloeosporium ampelophagum*), said to be identical with bird's-eye rot in America. Control measures include removal of diseased material and a hand-applied wash, prepared as indicated, of 25 lbs. iron sulphate and 1 pint sulphuric acid in 50 gal. of water. This is to be used on the dormant vines in winter, preferably at first at intervals of 15 days and later at 10 days, so long as considered necessary.

Peronospora parasitica, E. Gäumann (*Centbl. Bakt.* [*etc.*], *2. Abt.*, *45* (*1916*), *No. 18–25, pp. 575–577*).—Tabular data are given regarding the dimensions of conidia of *P. parasitica* as grown on different hosts.

Diseases of date in Morocco, E. Foex and P. Vayssière (*Jour. Agr. Trop.*, *19* (*1919*), *No. 162, pp. 336–339*).—A discussion of two diseases of date, supposedly related but undetermined as to causation, concludes with suggestions as to treatment.

Disease of lime seedlings [in Montserrat], F. Watts (*West Indies Imp. Dept. Agr. Montserrat Agr. Dept. Rpt.*, *1918–19, p. 40*).—In 1916, what appeared to be a new lime seed-bed disease resembling damping-off was observed. The apical portion of the plant was the first to show weakness in this case. The organism appeared to be one of the Peronosporaceae. Further observation has shown that young lime seedlings are invariably attacked by this disease, which is more accentuated in shaded situations. Bordeaux mixture checks the disease if applied on its first appearance.

A bacterial disease of ivy, G. Arnaud (*Compt. Rend. Acad. Sci.* [*Paris*], *171* (*1920*), *No. 2, pp. 121, 122*).—The author describes the effects observed on English ivy in Paris in June, 1920, of an attack by an organism which is designated as *Bacterium hederae* n. sp. The symptoms are said to resemble strongly those produced on bean by *Pseudomonas phaseoli* in America. Varieties are not equally susceptible. The disease appears to be favored by dampness.

The eelworm disease of the narcissus, J. K. Ramsbottom (*Brit. Florists' Fed., Florists' Bul.*, *1* (*1919*), *No. 1, pp. 11, 12*).—It is stated that nematodes can not withstand heat, as diseased bulbs soaked in hot water showed much less infection than untreated bulbs. This plan is still under investigation.

Gas poisoning in streetside trees, P. Ehrenberg and K. Schultze (*Ztschr. Pflanzenkrank.*, *26* (*1916*), *No. 2, pp. 65–83*).—A detailed account is given of studies related to gas poisoning of trees following up those noted (E. S. R., 31, p. 730).

Further studies on deformation of oak leaves, Zade (*Fühling's Landw. Ztg., 65 (1916), No. 23–24, pp. 549–559, fig. 1*).—This is a continuation, with tabular data and discussion, of studies previously noted (E. S. R., 33, p. 647).

ECONOMIC ZOOLOGY—ENTOMOLOGY.

The influence of man on animal life in Scotland.—A study in faunal evolution, J. Ritchie (*Cambridge: Univ. Press, 1920, pp. XVI+550, pls. 9, figs. 91*).—Following the introduction, the several chapters of this work relate to the domestication of animals, deliberate destruction of animal life, protection of animal life, the deliberate introduction of new animals, the destruction of the forest, influences of cultivation and civilization, camp followers of commerce (animals introduced unawares), and chains of circumstance.

Report of entomologist, W. E. Hinds and F. L. Thomas (*Alabama Col. Sta. Circ. 44 (1921), pp. 18–20*).—This report refers briefly to cotton dusting experiments for the boll weevil in 1920, the report covering which is noted above. The second generation of the fall army worm appeared the first part of July and did a tremendous amount of damage, especially to young corn, in 30 counties, chiefly on land that had been overflowed and under water for some time during the flooded conditions of December, 1919, and early spring of 1920. Reference is made to the appearance of the Mexican bean beetle (*Epilachna corrupta* Muls.), specimens of which were first received from the vicinity of Blocton and Birmingham in 1920. Reports on this pest by the senior author have been noted (E. S. R., 44, pp. 554, 751.)

[The rice bug and the rice leaf folder], G. Briggs (*Guam Sta. Rpt. 1919, p. 33*).—The rice bug (*Leptocorisa varicornis*) is said to have damaged late-maturing rice so badly that in several cases it was not harvested. The early-maturing strains of rice apparently escape a large part of the heavy infestation occurring from later broods of the rice bug. It was observed that rice on the experimental plats near cultivated fields was not damaged nearly so much as where grown near grass and brush land. The leaf folder was a source of considerable injury, especially to later plantings in the young stage. Its injury, caused by the folding of the leaves, results in a slow and very distorted growth.

Monthly notes on grubs and other cane pests, III, J. F. Illingworth (*Queensland Bur. Sugar Expt. Stas. Div. Ent. Bul. 10 (1920), pp. 39, figs. 3*).—This detailed report of work in progress from July, 1919, to July, 1920, is in continuation of reports previously noted (E. S. R., 42, p. 545).

The grape phylloxera in California, W. M. Davidson and R. L. Nougaret (*U. S. Dept. Agr. Bul. 903 (1921), pp. 128, pls. 11, figs. 10*).—This report deals with the history, injuries, and life history of the grape phylloxera in California, remedial measures having been left to be made the subject of another publication. The subject is dealt with under the headings: California history, accidental and natural spread, distribution of phylloxera in California, vineyard destruction, nomenclature and synonymy of the grape phylloxera, biology of the grape phylloxera in California, the radicicole, the nymph and winged form, nymphicals or intermediate forms, the sexual forms, the gallicole and its relation to California conditions, effects of water and heat on phylloxera, and diffusion of phylloxera, together with a summary and a list of the literature cited.

This pest must be known as *Phylloxera vitifoliæ* (Fitch), having been first described under that name in 1856 from the gall-inhabiting form, 12 years prior to Planchon's description of the root-inhabiting form under the name *Rhyzaphis vastatrix*. The pest was introduced into California about 1858 on vines imported by settlers from the eastern part of the United States, where it is a native, or about the time it reached France, where the first evidence of its activity was vaguely noted in 1862. It has since spread throughout most of the grape districts of California wherever conditions have been suited for it, but has never assumed such disastrous proportions as it did during the first years of its ravages in France. It is estimated that since its appearance in California, or during a period of 60 years, it has destroyed about 75,000 acres of grapes. It has in many cases been distributed through the agency of infested rooted vines imported into uninfested districts or vineyards, while in other cases it has been carried on vineyard material. Its modified life cycle in California, that is, sterility of the winged form, coupled with topographic barriers, consisting of mountain chains and dividing valleys, has prevented the rapid distribution in the State which took place in the vineyard districts of France.

Vines attacked when young, before their rooting systems have become established, will succumb more rapidly than those infested at a later age. The first indication of its presence in a vineyard occurs in the form of one or more stunted vines and in the premature yellowing of the foliage. Gradually more and more of the surrounding vines are affected, and those first infested become very much weakened or die outright. Following the initial infestation of a vine under favorable conditions for phylloxera, the pest multiplies rapidly and within two or three years increases its range to involve the entire root system. The phylloxera which settle on the growing rootlets form fleshy lesions or swellings, termed nodosities. In a great majority of instances further apical growth of the rootlet is stopped, and the rootlet ceases to supply nourishment to the vine. Other phylloxerae settle on the older roots, and in most cases cause swellings termed tuberosities, which vary in size, the majority being about 0.2 in. in diameter. The bark of the root often cracks longitudinally, and a chain of swellings arises from phylloxera punctures. So long as these swellings remain fresh, the health of the vine is not much impaired, but as soon as they decay the vine is injured. When they decay in numbers the roots are frequently destroyed, causing first the stunting and then the death of the vine.

Its life cycle in California has been found to be much more simple than that which obtains in the eastern United States, and as far as the economy of the insect is concerned, is purely parthenogenetic. Winter is passed in the form of hibernant larvae, which are newly hatched larvae that settle down immediately after hatching from the egg in the autumn, although a few hibernate in an older stage. With the first flow of sap in spring these hibernants commence to feed, and mature on the average 5.5 weeks later. The mature hibernant does not differ from the adult radicicole of any other generation. On the average, it takes the hibernant 6 months to mature, the period ranging from 4.5 to 7.5 months. The mature hibernant gives rise to a number of generations—as many as eight—of root-feeding phylloxerae throughout the summer and autumn. Although somewhat arbitrary, April 15 to October 15 best indicates the period of the active half year of the insect, the period October 15 to April 15 being the dormant or hibernating season.

All forms of phylloxera are oviparous, the average number of eggs per adult radicicole being about 110 and the average egg-laying period about 45 days. Incubation varies from 5 days in midsummer to over 30 days in December. Larvæ hatching in the spring mostly settle near the egg shells, but in summer and autumn a considerable percentage travel along the roots or forsake the vine altogether for other vines. Four molts are passed by the larvae, and on the completion of the final molt they become mature insects. The length of the developmental period varies according to food and meteorological conditions. On succulent living roots the average period of larval development was found to be about 22 days (hibernant generation excluded), and the maximum and minimum, respectively, 36 and 10 days.

The winged form is produced from the middle of June until November, it being more abundant in the coastal districts than in the interior valleys. In the first two instars the larvae of the winged form do not differ from the correseponding stages of the wingless form, but in the third and fourth stages they differ structurally, and in these stages are termed, respectively, prenymph and nymph. The nymphs have two pairs of grayish-black wing pads. The winged insect is orange in color with grayish-black head and thorax and two pairs of scantily veined wings.

"The nymphs transform in most instances near the surface of the soil, and the winged migrants issue on the surface and fly about in the vineyard and neighboring regions. The winged insects deposit eggs of two kinds, viz, male and female, and the insects which mature from these eggs are the true sexes. These forms are unable to take food, and under normal conditions mate upon reaching maturity, and the female forthwith deposits a single egg under the bark of the vine. This egg hatches in the spring and gives rise to a series of generations of gall-inhabiting and gall-making wingless aphids. A certain percentage of larvae born in the galls, however, migrate to the roots before taking food, and in this way the species returns to the soil.

"In California, under natural conditions, it is doubtful whether any sexes mature and still more doubtful whether any winter eggs hatch. Laboratory experiments indicate that the sexes mature in about 12 days.

"In the late autumn, along with the nymphs are found curious forms intermediate in appearance between adult radicicoles and nymphs. These are called intermediates or nymphicals. They are not abundant, and all those whose progeny have been observed were parthenogenetic.

"The diffusion of the phylloxera is effected in nature by the wandering newly hatched larvae of the radicicoles during summer and autumn. These pass from vine to vine, either on the surface of the soil or through subterranean cracks or pathways. They may also be borne by the wind or on vineyard material, such as picking boxes. Probably water is responsible for some diffusion in hilly or irrigated vineyards, and cultivating instruments, by picking up pieces of infested roots, may effect fresh infestations. The phylloxera is easily introduced into a vineyard or section by the practice of planting infested rooted vines to make up for cuttings which did not succeed in previous years."

A list is given of 23 references to the literature cited.

[Mosquitoes and disease transmission] (*Meded. Burgerl. Geneesk. Dienst Nederland. Indië, 1919, Nos. 1, pp. 84, pls. 10; 2, pp. 82, pls. 9, figs. 2; 3, pp. 88, pts. 8; 6, pp. 47, pls. 21; 7, pp. 39–85, pl. 1; 9, pp. 53–71, pls. 2+[addenda to 6], pp. 3, pls. 2; 10, pp. 168, pls. 32*).—The following papers relate to mosquitoes and to their rôle in the transmission of the causative agents of disease: No. 1, Report of a Journey for the Purpose of Studying Hygienic Conditions in the United States of North America, Panama, and Cuba, made by the Order of the Netherlands Minister for Colonial Affairs, by C. W. F. Winckel (pp. 1–84); No. 2, Malaria in Weltevreden and Batavia, by M. L. van Breemen (pp. 1–40), and Anophelines of West Java, by R. M. M. Mangkoewinoto (pp. 41–82); No. 3, The Susceptibility of Anophelines to Malarial Infections in Netherlands India, by N. H. Swellengrebel et al. (pp. 1–64), and On the Biology of *Myzomyia ludlowi* in Sumatra, by W. Schüffner et al. (pp. 65–88); No. 6, Description of the

Anopheline Larvae of Netherlands India, so far as They are Known Till Now, by N. H. Swellengrebel and J. M. H. Swellengrebel de Graaf (pp. 1–47; addenda, No. 9, pp. 3); No. 7, On the Requirements of Different Anophelines in Regard to the Abode of their Larvae, by N. H. Swellengrebel and J. M. H. Swellengrebel de Graaf (pp. 39–85); No. 9, Report on Experiments upon the Development of Malaria Parasites in some Anophelines, by N. H. Swellengrebel (pp. 53–71); and No. 10, *Myobium myzomyiae*, a Parasitic Haplosporidium Found in the Intestinal Tract of Some Anophelinae, by N. H. Swellengrebel (pp. 68–72), and Researches on the Anophelines at Some Stations of Java and Sumatra in Connection with the Occurrence of Malaria (pp. 1–67), Malaria in Modjowarno (pp. 73–112); and Report on the Occurrence of Malaria and Anophelines at Samarang (pp. 113–168), all by N. H. Swellengrebel and J. M. H. Swellengrebel de Graaf.

[Combating tobacco worms], G. Briggs (*Guam Sta. Rpt. 1919, pp. 34, 35*).—Tests made on four plats of 0.2 acre each showed the control of tobacco worms by spraying to be profitable. While the cost of hand worming was 40 cts. less per plat, the increased yield in the sprayed plats more than made up the difference.

The larger cornstalk borer in North Carolina, Diatraea zeacolella Dyar, R. W. Leiby (*N. C. Dept. Agr. Bul., 41 (1920), No. 13, pp. 85, figs. 27*).—This account is based upon a review of the literature and investigations commenced in 1915 and conducted continuously over a period of five years at the substations in Edgecombe and Pender Counties, supplemented with observations and breeding experiments at Raleigh. The investigations reported relate to the life history of the insect, a determination of the seasonal degree of infestation at several localities during each of the years, the causes of natural mortality, and the practical effectiveness of certain control measures, which were experimentally carried out following life history studies, for the purpose of reducing prevalent injuries.

The species is distinctly two brooded, one brood occurring in spring and early summer, known as the first brood, the other occurring in late summer, fall, and winter and known as the second brood. The winter is passed as a larva, about 0.75 in. long, in the taproot of the corn stubble. It becomes active early in the spring, and transformation to the pupal stage begins April 20, continuing to May 20, most of the larvae having pupated by May 10. The spring pupal stage occupies about 20 days, the moths beginning to emerge in small numbers about May 5 and the crest of the emergence period being reached from May 22 to 24. Oviposition commences within 48 hours after emergence from the pupae, and the moths live about a week.

The eggs are found in the field on early planted corn in small numbers about May 10. Most of them are deposited by May 25, but a few as late as June 5 by straggling adults. The incubation of the egg of the first brood requires a period of about 9 days. The larvae begin to appear about May 15 and are found in increasing numbers up to June 7, remaining at the high level until July 7, when some begin to transform to pupae. The length of the larval stage varies considerably but approximates 35 days, during which time the larvae have fed within the "throat" of the corn and tunneled in the cornstalk. Transformation to the pupal stage, which takes place within the tunnel of the stalk, begins about July 7, with most of the larvae pupated by July 25. The duration of the pupal stage of this brood is about 12 days.

The moths of the second brood are present in the field in maximum numbers about July 31, and eggs are deposited on corn beginning 2 days after emergence and continuing for about 3 days. The incubation period of the eggs of the second brood is about 7.8 days. The larvæ again attack the corn by feeding in the "throat" of corn planted late, or tunneling in the stalk of early planted corn. As the larvae become grown and the cornstalks become dry, the larvae work downward and bore in the taproot, this happening in October. Here a tunnel is made and a chamber cleaned out where the insect passes the winter as a fully grown white robust larva.

No parasites have been reared from the larvae, but two hymenopterous species have been reared from the pupae. The egg parasite, *Trichogramma minutum* Riley, is by far the most common parasite of the borer in North Carolina. A very high percentage of the winter mortality of hibernating larvae is caused by two fungus parasites.

Control measures recommended include a delay in corn planting until May 25 or later, so that the corn will not be attacked by the first brood of larvae. Such corn will make a good growth by July 20, when the second brood of larvae will begin its work; but it will not be seriously injured by the second brood, even though a high percentage of the stalks may be infested. Disturbing the stubble in the fall by plowing it out (laying it on the ground) or by general plowing in the field causes 85 to 95 per cent of the larvae to die during the winter, or 25 to 50 per cent more than would normally die. It is stated that a combination of these two control measures, if practiced over a period of one or two years, will reduce stalk-borer injury to the minimum, if not locally eradicate it. The plowing of stubble land as early as possible before May 15, followed by harrowing, burning of the stalks and stubble during the winter or early spring, and rotation are recommended.

A bibliography of 19 titles is included.

Studies in the biology of the Mexican cotton boll weevil on short-staple upland, long-staple upland, and Sea Island cottons, G. D. SMITH (*U. S. Dept. Agr. Bul. 926 (1921), pp. 44, pl. 1, figs. 18*).—This is a report of studies conducted at Madison, Fla., during the years 1918 and 1919, in which a short-staple upland cotton known as King, a long-staple variety known as Webber No. 49, and a Sea Island cotton known as Hope Straight were used. The data, which are reported in large part in tabular form, have led to the following summary and conclusions:

"At Madison, Fla., the average longevity of hibernated weevils without food was 12.7 days, and 18.8 days when fed on cotton plantlets. Adult weevils of the first and second generations lived 24.3 days on cotton squares and 12.3 days on cotton bolls. On Sea Island cotton plantlets the hibernated weevils lived 11.05 days. The first and second generation weevils fed on Sea Island cotton squares lived 10.7 days, while the weevils fed on Sea Island cotton bolls lived only 15.3 days. There is practically no difference in the longevity of boll weevils on Sea Island and upland cottons.

"The average period from the time the weevils become adult to oviposition at Madison, for all experiments, was 8.9 days for weevils bred under insectary conditions and 7.07 days for weevils bred under field conditions. The average period of oviposition under insectary conditions for all weevils under observation on upland cotton was 33.1 days. The entire series deposited eggs over an average period of 31.7 days on Sea Island cotton. The largest number of eggs deposited by a single female weevil was 432. This record was made by a hibernated female on upland cotton squares under insectary conditions. The largest number of eggs deposited during any one day under insectary conditions was 25. This record was also made by a hibernated female weevil.

"The average period from oviposition to adult of all weevils bred under insectary conditions on upland cotton squares was 14.91 days. On Sea Island cotton the average period from egg to adult for all weevils bred under insectary conditions was 14.94 days. The field-bred weevils showed more vitality than weevils bred under artificial conditions. Under field conditions the average length of time the infested squares hung on the upland cotton plants after egg puncture was 11.5 days. The time required to complete the development of the immature weevil after the infested square dropped to the ground was 10.8 days in upland cotton squares.

"There was practically no difference shown in the length of the developmental period of the boll weevils bred in short-staple upland, long-staple upland, and Sea Island cotton squares. The developmental period of the boll weevil was approximately 7.5 days longer under field conditions than under insectary conditions at Madison, Fla. Soil temperatures of 120° F. and higher are usually fatal to the immature weevils under field conditions.

"The boll weevil at Madison, Fla., shows a decided tendency to form a new variety. The hibernation of the weevil at Madison is incomplete, and the adults are seldom inactive more than 30 days at a time.

"The emergence from hibernation of the weevil in Florida is very gradual, the total daily emergence bearing a direct relation to the total daily rainfall. Weevils survived the winter in larger numbers in cages set on the ground in the woods than in the open field or in cages in trees 10 ft. above ground. Weevils placed in hibernation cages on November 15 survived in larger numbers than on any other date of installation. The percentage of total emergence from hibernation begins with more acceleration in Florida than in Texas up to the time that 25 per cent emerges. After 25 per cent of the weevils have emerged in Florida the emergence is less rapid, and the Florida emergence curve very closely approaches the emergence curve for Louisiana. The total percentage of hibernating weevils that survived the winter of 1918–19 at Madison was 7.54."

Poisoning the boll weevil, W. E. HINDS and F. L. THOMAS (*Alabama Col. Sta. Bul. 212 (1920), pp. 53–84, fig. 1*).—The first part of this bulletin (pp. 53–77), relating to dusting experiments conducted during the years 1918 and 1919 and presented in large part in tabular form, has been summarized in an account previously noted (E. S. R., 43, p. 561).

Part 2 (pp. 78–84) presents a summary of the results of the dusting work continued during the year 1920, the details relating to which were destroyed when the laboratory building was burned in the fall of that year. A traction-machine-dusted plat of 3 acres, with 1.5 acres check, on which applications were made July 29 and August 3, 7, and 21, at the average rate of 7 lbs. per acre of calcium arsenate, gave an average yield of 1,260 lbs. of seed cotton per acre from the dusted and 888 lbs. per acre from the check plat. Figuring the value of the increase in yield at 6.5 cts. per pound of seed cotton, it amounted to an increase of $24.18 per acre, and upon deducting the cost of treatment, $8.16 per acre, there was a margin of $16 profit per acre.

On another plat of 5 acres on the same plantation, with less fertile soil, where three dustings were applied, the third being washed off by heavy rains, the yield averaged 678 lbs. seed cotton per acre, while the check gave 596 lbs. While there was an apparent loss of 32 cts. per acre, the infestation of the treated area was higher than that of the check, being on August 3d 20 per cent as against 12.7 per cent. The yield on treated cotton was increased about 14 per cent, thus actually paying a small profit.

On a 30-acre tract of fine sandy loam at Geneva, which was given four applications between July 6 and August 10, the results were deemed very satisfactory and profitable.

The 2-wheeled, traction-driven type of machines operated by one man, which was manufactured by several companies and placed on the market in 1920, almost entirely superseded the gas-engine-driven type of duster, and demonstrated its practicability, reliability, and economy of operation in spite of minor weaknesses which developed under field use.

In conclusion, it is pointed out that weather conditions will always affect the dusting problem. Appearances thus far in Alabama indicate that every effort should be made to continue dusting at the usual 4- or 5-day intervals in spite of threatening weather during periods of frequent rains. If, however, the weather is sufficiently hot and dry for a period of more than a month, and especially during the first part of the fruiting season, the weevils may be controlled thereby so fully that dusting will not be needed or will not pay.

Parasitism by Aphiochaeta (Phora) fasciata Fallen, J.-L. Lichtenstein (*Compt. Rend. Acad. Sci. [Paris], 170 (1920), No. 9, pp. 531–534, figs. 3*).—The author finds *A. fasciata* to be a true parasite of the nymphs of Coccinellidae. The female invariably oviposits on nymphs, always waiting until the last stage. The eggs are deposited externally on the host, and several may be placed on the same nymph. The larva emerges in 1.5 or 2 days and penetrates the host, not more than three or four being able to complete their development in a nymph.

Winter treatment for honeybees, C. E. Sanborn (*Oklahoma Sta. Circ. 48 (1920), pp. 4, figs. 3*).—This is a brief popular account, summarizing the proper procedure and including the method of wrapping the hive.

FOODS—HUMAN NUTRITION.

[Some papers on nutrition and health] (*Commonhealth [Mass. Dept. Pub. Health], 7 (1920), No. 4, pp. 203–281, figs. 10*).—This contains a bibliography on school lunches, two short plays suitable for children, and a number of papers, including The Development of Nutrition Activities by the Massachusetts Department of Public Health, by E. R. Kelley; A Nutritional Program for Massachusetts, by M. Champion; Nutrition Work in the Schools of New York State, by M. G. McCormick; Malnutrition, by L. H. Gillett; Nutrition of Children, by F. B. Talbot; Food Accessory Factors in Relation to the Teeth and Bones, by P. R. Howe; Bodily Mechanics: Its Relation to Nutritional Disorders, by L. T. Brown; The Training of Women for Health Work in Nutrition, by A. Blood; A Food Center as a Part of the Board of Health, by R. G. Hopkins, E. A. Harvey, and E. P. Lewis; and Hot Lunches in Our Schools, by L. Comstock.

Some famine foods in Ahamedabad, G. P. Pathak (*Agr. Jour. India, 15 (1920), No. 1, pp. 40–44*).—Some information regarding the nature, preparation, and food value of a number of articles is given, including the rhizomes of two sedges (*Scirpus kysoar* and *Carex bulbosus*), the inflorescense of *Typha angustata*, and the tubers of a water lily (*Nymphea stillata*).

Relation of grade, class, and originating point of wheat to volume of bread baked from flour made therefrom, S. J. Lawellin (*Jour. Amer. Assoc. Cereal Chem., 6 (1921), No. 1, pp. 7–10*).—Details of baking tests are reported and discussed. In the author's opinion, work of this sort is quite valuable in judging wheat.

Chemical control in the bakery, R. W. Mitchell (*Jour. Amer. Assoc. Cereal Chem., 6 (1921), No. 1, pp. 11–13*).—A discussion of commercial breadmaking problem with special relation to chemistry.

On the preservation of the antiscorbutic properties of cabbage by drying, A. Holst and T. Frölich (*Jour. Trop. Med. and Hyg. [London], 23 (1920), No. 21, pp. 261–263*).—The authors have extended their previous studies on the antiscorbutic properties of cabbage (E. S. R., 27, p. 567) by an investigation of the effect of various methods of treatment after preliminary drying.

Slices of cabbage dried for one week in an incubator at 37° C., further dehydrated in the incubator by the action of phosphorus pentoxid, and then placed in vacuum bottles and stored at the same temperature showed very pronounced antiscorbutic properties after from 18 to 26 months. Cabbage dried at 37° but not treated with phosphorus pentoxid lost most of its antiscorbutic properties when kept for 18 months at 37° in closed vessels with calcium chlorid, but retained its properties to a certain extent when kept at from 4 to 12°. Samples kept at 4° in closed vessels without being previously dried showed moderate antiscorbutic properties at the end of 18 months.

Fat-soluble content of oils, A. D. Stammers (*Brit. Med. Jour., No. 3128 (1920), pp. 919, 920*).—Attention is called to the necessity, in reporting the presence or absence of fat-soluble A in oils, of giving the history of the sample used with the processes through which it has passed.

Digestibility of some hydrogenated oils, A. D. Holmes and H. J. Deuel, Jr. (*Amer. Jour. Physiol., 54 (1921), No. 3, pp. 479–488*).—The digestibility of cottonseed, peanut, and corn oils partially hydrogenated to give hardened oils of different melting points was determined by the methods employed in previous studies from the Office of Home Economics, U. S. Department of Agriculture (E. S. R., 42, p. 552).

None of the oils caused any observable digestive disturbances or decreased the digestibility of the experimental diet as a whole. Although the coefficient of digestibility decreased as the melting point of the fat increased, all of the oils with the exception of the sample of peanut oil melting at 52.4° C. and of corn oil melting at 50° were 92 per cent or more digested. The highest coefficient of digestibility obtained was with a hardened peanut oil melting at 37°, which gave a percentage digestibility of 98.1. The authors conclude that these hydrogenated oils are as well utilized as natural fats of corresponding melting points.

The control and manufacture of saccharin, O. Beyer (*Ueber die Kontrolle und Herstellung von Saccharin. Zurich: Rascher & Co., 1918, pp. 141, figs. 12*).—This is a collection of information on the manufacture, properties, determinations, uses, and physiological effects of saccharin and its by-products. An extensive list of references to the literature on saccharin, including patent literature, is appended.

Comparison of the bacterial counts from machine and hand washed dishes and their significance, R. S. Dearstyne (*Amer. Jour. Pub. Health, 10 (1920), No. 11, pp. 871–873, fig. 1*).—Tabulations are given of the bacterial counts obtained from the eating utensils at restaurants where various methods of cleaning the dishes were used. The data show a very much higher bacterial count in hand-washed than in machine-washed dishes.

Adsorption of cyanid gas by foodstuffs (*Pub. Health Rpts. [U. S.], 35 (1920), No. 27, p. 1597*).—The question of the possibility of adsorption of cyanid gas by foodstuffs exposed in the process of fumigation of vessels, warehouses, etc., was tested by exposing bread and milk to the gas under a bell jar for from 2 to 22 hours and then feeding it to white mice (with or without preliminary exposure to air).

With excessive amounts of the cyanid, death followed the ingestion of the bread and milk if taken immediately after the removal of the bell jar. If allowed to stand for some time, no ill results were noted. This is thought to indicate that the possibility of poisoning occurring from the consumption of food materials exposed to cyanid gas is very slight.

Red Cross course in food selection (*Washington, D. C.: Amer. Red Cross, 1921, pp. 100*).—The material included in this pamphlet, though written primarily for Red Cross classes in food selection, can be used by women interested in the problems of feeding the family. The lessons, 15 in number, deal with factors which must be considered in selecting an adequate diet, and the course, as a whole, aims to give a knowledge of foods and food groups, and so enable the housekeeper to modify her selection of food to suit the needs of the individual members of the family.

The matter of food selection for rational life is very much simplified for teaching purposes by following the convention of dividing the food supply into five groups, and recommending that all groups be well represented in the diet. The groups are (1) vegetables and fruits; (2) foods rich in protein; (3) cereals and cereal products; (4) sugars and other sweets; and (5) fats and fatty foods. A special lesson is devoted to milk. Fruit and beverages are also considered, as well as calculations on the food value and the cost of the diet; infant feeding and food for the child; and feeding in special cases.

In the preparation of this publication the Office of Home Economics of the U. S. Department of Agriculture and a number of individuals cooperated with the Red Cross.

The question of correct diet, M. Greig (*Nat. Hist., 20 (1920), No. 5, pp. 587–591, figs. 3*).—A traveling exhibit designed to illustrate correct principles of diet, prepared by the New York City Department of Education in cooperation with the American Museum of Natural History, is described, and examples are given of meals so made up that they provide a healthful diet for a child from 10 to 13 years of age. The exhibit includes 16 wax models of foods, eight wall charts, and a set of colored blocks showing the composition of six common foods.

The contribution of European experience on low diets to our teaching of dietetics, A. F. Morgan (*Jour. Home Econ., 13 (1921), Nos. 2, pp. 49–53; 4, 157–168*).—Much information (some of it not readily accessible) is summarized and discussed with reference to the effects of low diet during the war and after it.

The food of the immigrant in relation to health, M. M. Davis, jr. and B. M. Wood (*Jour. Home Econ., 13 (1921), Nos. 1, pp. 19–25; 2, pp. 66–74*).—The authors have summarized much useful information regarding the diet of immigrants, and ways are suggested for teaching them how to make wise and rational use of American foods and in general to adapt themselves to American ways of housekeeping.

Diet for the school child, L. H. Gillett (*U. S. Bur. Ed., Health Ed. No. 2 (1919), pp. 1–14, figs. 10*).—This discussion of food in relation to health is designed particularly to interest and instruct children. The text is followed by sample menus for children from 7 to 12 years of age in summer and in winter.

The lunch hour at school, K. A. Fisher (*U. S. Bur. Ed., Health Ed. No. 7 (1920), pp. 3–62*).—Various school lunch problems are discussed, including school lunches and health education, special nutrition work for undernourished children, the social aspects of the school lunch, supplying lunches to poorer children, school lunches in rural schools, lunches in high and normal schools, the elementary school lunch, the hot lunch in consolidated schools, equipment for school lunch rooms, business methods, and related topics. Some selected recipes are included, as well as a list of references.

Malnutrition and school lunches in the elementary schools of Chicago, L. E. Blauch (*[Ill.] Inst. Quart., 11 (1920), No. 4, pp. 111–118*).—In addition to some historical and other general data, information is summarized regarding the elementary school lunch work in Chicago.

Calcium in the blood of children, W. Denis and F. B. Talbot (*Amer. Jour. Diseases Children, 21 (1921), No. 1, pp. 29–37*).—The results are reported and discussed of a series of calcium determinations on the blood of 119 children of unselected hospital cases of different disorders. Calcium was determined by the Lyman method (E. S. R., 37, p. 207), modified by the use of citrated plasma instead of whole blood and three calcium standards for comparison instead of one.

The extreme range of calcium in these cases was from a minimum of 1 mg. per 100 cc. of blood plasma to a maximum of 13.5 mg. Although the calcium values of the blood of 28 cases of rickets were in general distinctly below normal, the authors are of the opinion that too great significance can not be attached to these results, as several of the patients were also suffering from other maladies (pneumonia predominating) which might affect the calcium level in the blood.

In a number of these cases magnesium determinations were also made by the method of Denis, previously noted (E. S. R., 42, p. 712).

Zinc in the human organism, S. Giaya (*Compt. Rend. Acad. Sci. [Paris], 170 (1920), No. 15, pp. 906–909*).—Determinations of zinc in human viscera are reported which confirm the conclusions of Ghigliotto (E. S. R., 41, p. 465) and of Rost and Weitzel (E. S. R., 42, p. 758) that zinc is a normal constituent of the human body. The study of the distribution in different organs showed its presence in decreasing amounts in the following order: Brains, lungs, stomach, liver, kidneys, intestines, heart, and spleen. The urine contained very little (0.00017 gm. per liter), while human milk contained about 0.0013 gm. per liter. In the viscera examined the amount of zinc was found to increase with the age of the subject. This is thought to be due to a gradual accumulation in the system of small quantities ingested with the food.

The presence of creatinin and creatin in the blood in normal and pathological conditions.—IV. Revision of former methods and results. A comparison of methods, J. Feigl (*Biochem. Ztschr., 105 (1920), No. 4–6, pp. 255–281*).—This paper, which is in continuation of previous studies (E. S. R., 40, p. 765), consists in a discussion and comparison of the results obtained in the use of recent modifications of methods of determining creatin and creatinin. The author is of the opinion that the values obtained for creatin under present conditions are of little significance, while preformed creatin is the variable factor in pathological conditions.

The pigments of the adrenals, G. M. Findlay (*Jour. Path. and Bact., 23 (1920), No. 4, pp. 482–489*).—Recent studies on the lipochrome pigments of the animal body and their derivation from vegetable tissues are reviewed, and a study is reported of the pigments of the human adrenals in normal and pathological cases and of the adrenals of hens on different diets. Tests used in distinguishing xanthophyll, carotin, and melanin are described, solubility in petroleum ether being used to differentiate carotin from xanthophyll, and the blue coloration with Nile-blue sulphate to distinguish lipochrome granules from melanin, which gives a green color with the same reagent.

A decrease in the lipochrome of the adrenals of hens on a diet of polished rice and a marked increase on a diet of yellow corn and oats is thought to indicate that the amount of lipochrome may be varied at will by alterations in the lipochrome content of the food. That the decrease in lipochrome on a diet of polished rice is not due to lack of water-soluble B is considered proved by the fact that in man beriberi can develop even when the food contains a normal supply of lipochrome pigment.

The study of normal human adrenals obtained in cases of accidental death showed that there are present in the adrenals under normal conditions at least two lipochrome pigments, one of which is soluble (carotin) and the other insoluble (xanthophyll) in petroleum ether. Melanin pigment was also demonstrated in the first months of extra-uterine life and in old age.

In pathological conditions of an acute character the amount of lipochrome pigment in the adrenals was generally increased, while no melanin pigment was found. In chronic diseases there was not only a considerable increase in lipochrome, but melanin was found to be present in both the cortical and in the medullary cells.

Further studies on intestinal implantation of Bacillus acidophilus, H. A. CHEPLIN and L. F. RETTGER (*Soc. Expt. Biol. and Med. Proc., 18 (1920), No. 1, pp. 30–32*).—The conclusions drawn from earlier observations on the intestinal implantation of *B. acidophilus* (E. S. R., 43, p. 769) are confirmed, and the preparation and properties of *B. acidophilus* milk are briefly described.

Changes in organ weight produced by diets deficient in antiscorbutic vitamin, V. K. LAMER and H. L. CAMPBELL (*Soc. Expt. Biol. and Med. Proc., 18 (1920), No. 1, p. 32*).—The authors report that in young guinea pigs fed on a diet deficient in water-soluble C the adrenals at autopsy show a definite increase in size over the normal and a still more marked increase in weight, at times approximating 100 per cent when computed on the basis of body weight minus alimentary canal. The increase in weight of the adrenals was proportional to the length of time the animal was on the scorbutic diet, and was particularly pronounced in animals which had been kept alive for a longer period by the administration of small but insufficient amounts of orange juice.

"This may be interpreted as indicating a compensatory response to the decreased adrenalin production known to exist in the scorbutic animal. This point is of interest in connection with the extensive intramuscular and intestinal hemorrhages found in scurvy."

No evidence was obtained that the liver is affected by a lack of water-soluble C alone, although there was some indication that the heart and kidneys are enlarged on the scorbutic diets.

Protein and carbohydrate equivalents in the diabetic dietary, E. M. EWING (*Jour. Amer. Med. Assoc., 76 (1921), No. 5, pp. 300, 301*).—A diet list for diabetics is presented in which the foods are divided into four groups, the first three predominating, respectively, in protein, carbohydrate, and fat, and the fourth consisting of miscellaneous articles to be added to the dietary without allowing for food value, such as coffee, washed bran, etc.

In the protein group the weight of each article of food is such as to furnish 6 gm. of protein, this amount being chosen on account of its being the average protein content of eggs, certain diabetic muffins, etc. Each of the carbohydrate portions furnishes 5 gm. of carbohydrate. The portions of fat have not been made equivalent, but represent convenient amounts. With each food in every list is given the amount in grams of protein, fat, and carbohydrate furnished, from which the total calorific value can be readily calculated.

The prevention of diabetes mellitus, E. P. JOSLIN (*Jour. Amer. Med. Assoc., 76 (1921), No. 2, pp. 79–84*).—This is essentially a discussion of the relation of obesity to diabetes.

Recent work on pellagra, C. VOEGTLIN (*Pub. Health Rpts. [U. S.], 35 (1920), No. 25, pp. 1435–1452, fig. 1*).—In this paper, read before the Harvey Society of New York on January 24, 1920, the author summarizes the work that has been done by the U. S. Public Health Service and by other investigators in the attempt to explain the origin of pellagra. The conclusion is drawn that diet is the essential factor in the production and cure of the disease, and that while the nature of the dietary defect has not been discovered, observations point to a combined deficiency in some of the well recognized dietary factors as the cause of the pellagrous syndrome. An extensive list of literature references is appended.

A study of the leucocyte changes in pellagra compared with those occurring in beriberi, G. M. FINDLAY (*Jour. Path. and Bact., 23 (1920), No. 4, pp. 490–498*).—Determinations are reported of the leucocyte changes in pellagra, as determined by comparison of the blood findings in a number of cases of uncomplicated pellagra with those of healthy controls on the same diet. The data on pellagra cases are then compared with similar data from cases of beriberi, with the following conclusions:

"In pellagra there is a slight increase in the total, but a decrease in the percentage, neutrophil count. In beriberi there is a decrease in the total, but not in the percentage, neutrophil count.

"In pellagra there is an increase both in the total and percentage, lymphocyte count. In beriberi there is a decrease in the total, but not in the percentage, lymphocyte count."

A consideration of the gastric test meal from experimental data, M. E. REHFUSS and P. B. HAWK (*Jour. Amer. Med. Assoc., 75 (1920), No. 7, pp. 449–452*).—This is a brief discussion of gastric analysis and its interpretation, based largely on the studies from the authors' laboratory previously noted (E. S. R., 44, p. 665).

A simple device for measuring basal metabolism, H. M. JONES (*Jour. Amer. Med. Assoc., 75 (1920), No. 8, pp. 538, 539, figs. 2*).—A brief description with accompanying photograph and diagram is given of a portable respiration apparatus which is said to have the advantages over the Benedict apparatus of being actually portable, requiring no electrical connection for operation, and involving no mathematical calculations.

Basal metabolism determinations.—Tests with two portable closed-circuit respiration apparatus, H. N. TIHEN (*Jour. Amer. Med. Assoc., 76 (1921), No. 2, pp. 86–88*).—A comparison of the Benedict apparatus for determining basal metabolism and the Jones apparatus noted above was made by duplicate determinations with each apparatus on 20 different subjects.

The average percentage variation between the two readings with the Benedict apparatus was 3.5 per cent and with the Jones 3.7 per cent, while the average difference in variations of determinations with the two sets of apparatus was 3.9 per cent. Five successive determinations on one patient with the Jones apparatus resulted in a maximum variation of slightly less than 4 per cent, while with five determinations on a normal subject a maximum variation of 3 per cent was obtained.

The author concludes that suitable clinical accuracy can be obtained with either apparatus, but that the Jones apparatus, "because of its compactness, relative simplicity, and accuracy, is especially valuable for clinical use."

The determination of the basal metabolic rate, and its value in diseases of the thyroid gland, C. M. and D. WILSON (*Lancet [London], 1920, II, No. 21, pp. 1042–1045*).—This is a discussion of the method of determining basal metabolism by indirect calorimetry and the value of this determination to clinicians in diagnosing diseases of the thyroid gland.

The fundamental classification of disease by the basal metabolic rate, W. M. BOOTHBY (*Jour. Amer. Med. Assoc., 76 (1921), No. 2, pp. 84–86*).—The author discusses the significance of the basal metabolic rate in the diagnosis of disease, pointing out that as the clinical thermometer divides diseases into the febrile and afebrile groups, the basal metabolic rates differentiate diseases into three distinct groups, those with normal, increased, and decreased basal metabolic rates. While a very high percentage of all abnormal basal metabolic rates are dependent on or accompanied by an altered function of the thyroid gland, the rate is shown to have a greater significance than as a test for hypo- or hyperthyroidism.

"The 'normal' standard of the basal metabolic rate is not exact, yet the comparatively small 'normal' variation, compared to the wide range of pathologic variation, admits of fully as accurate grouping of diseases as does the body temperature. It is to be hoped that the value of basal metabolic rates will not be discredited by carelessness in technique and a failure to appreciate the necessity for carrying out all the technical and physiologic details requisite for obtaining accurate basal metabolic rates."

ANIMAL PRODUCTION.

The mammary apparatus of the Mammalia, E. Bresslau (*London: Methuen & Co., Ltd., 1920, pp. VII+145, figs. 47*).—This volume consists of three chapters dealing with the structure and development of the mammary glands in monotremes, marsupials, and placental mammals, respectively. The author's main interest is in the phylogenetic history of the Mammalia. There is a bibliography of about 45 titles, none later than 1911.

Studies on the mammary gland.—VI, The development of the mammary gland from its earliest appearance until the period of pregnancy, J. A. Myers (*Amer. Jour. Diseases Children, 18 (1919), No. 1, pp. 4–13*).—This paper is essentially a summary of the author's observations on the mammary gland of the rat reported in his earlier studies (E. S. R., 42, p. 667) and a survey of relevant literature on other species of mammals, including man.

The development of the secretory ducts of the mammary gland.—Researches on cattle, M. Zschokke (*Arch. Mikros. Anat., 93 (1919), No. 2–3, I, pp. 184–209, pl. 1, fig. 1*).—The author's material consisted of histological preparations of the mammary glands of 30 bovine fetuses and 3 young heifer calves, and he describes the development of the primary and secondary ducts, the milk cistern and teats, and the histological differentiation of the gland tissues. There is a bibliography of 66 titles.

Composition of the bovine at birth, L. D. Haigh, C. R. Moulton, and P. F. Trowbridge (*Missouri Sta. Research Bul. 38 (1920), pp. 3–47, pl. 1*).—Seven Jersey fetuses and young calves and 13 Hereford new-born calves were used in this study. There were three groups of Hereford calves produced by dams that had been, respectively, on high, medium, and low planes of nutrition during gestation. The Jersey calves did not form an experimental group, as some were the products of abortion and some others were born dead. In general, data from only two calves are included in the Jersey averages. Tables give for each calf, with certain incidental exceptions, the weights of the blood, hair and hide, composite flesh, 23 internal organs, skeleton, excreta, and kidney fat, and the chemical composition of the blood, liver, nervous system, total internal organs, hide and skin, skeleton, flesh, bone marrow, kidney fat, intestinal contents, and the entire animal. The following are the average of the analyses of the calves, the flesh, and the skeleton for each breed and group:

Chemical composition of new-born calves.

Breed of calves and nutrition plane of dams.	Entire calf.					Composite flesh.				Skeleton.				
	Water.	Fat.	Nitrogen.	Ash.	Phosphorus.	Water.	Fat.	Nitrogen.	Ash.	Water.	Fat.	Nitrogen.	Ash.	Phosphorus.
Hereford:	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
High plane	72.4	4.15	3.00	4.15	0.805	76.3	4.41	2.79	0.984	64.3	3.97	2.88	12.81	2.60
Medium plane	72.5	3.57	2.97	4.51	.809	76.5	4.07	2.77	.988	65.0	3.36	2.85	13.18	2.51
Low plane	73.6	3.24	2.81	4.91	.915	78.2	3.62	2.57	.993	65.4	3.03	2.78	13.57	2.67
Average of all	72.8	3.65	2.93	4.52	.841	77.0	4.01	2.71	.989	64.9	3.45	2.83	13.19	2.59
Jersey	73.4	3.82	2.88	4.15	.681	77.4	3.12	3.19	.974	63.0	2.18	3.21	13.83	2.43

The stomachs and intestines of the Jersey calves were heavier in proportion to body weight than those of the Herefords and the small intestines were longer. The Herefords also had heavier hides, but otherwise there were no distinctive breed differences noted.

Most of the fat in these calves was found with the internal organs. Attention is called to the fact that the sums of the percentages of fat and water tend toward a characteristic constant value for each tissue and the calf as a whole, without regard to the breed or the plane of nutrition of the dam.

Commercial feeding stuffs, F. D. Fuller (*Texas Sta. Bul. 268 (1920), pp. 5–233*).—This publication tabulates alphabetically by manufacturers the proximate analyses of samples of feeding stuffs collected during the year ended August 31, 1920. The materials include alfalfa meal, barley chop, dried beet pulp, brewers' dried grains, coconut oil meal, corn bran, corn chop, ground corn cob, corn and cob meal, ear corn chop with husks, unbolted corn meal, corn gluten feed, hominy feed. cold pressed cotton seed (prime and choice), cottonseed feed, cottonseed cake (prime and ordinary), cottonseed meal (prime and ordinary), ground feterita fodder, feterita head chop, kafir chop, milo chop, milo head chop, ground oats, whole pressed peanuts, peanut feed, peanut oil meal (prime and ordinary), rice bran, rice polish, rice screenings, whole pressed velvet bean, ground wheat, wheat bran (with and without screenings), brown, gray, and white shorts (with and without screenings), wheat mixed feed, wheat screenings, red dog, meat scrap, shrimp scrap, and a variety of proprietary mixtures. The sample of shrimp scrap analyzed contained 49.96 per cent crude protein.

A table showing the average composition of most of the varieties of feeds analyzed is included, as well as introductory matter dealing with the administration of the State feed law.

The Texas Feed Law.—Requirements and administration, F. D. Fuller (*Texas Sta. Control Circ. F (1919), pp. 5–20. figs. 2*).—This contains the text of the Texas Feed Law, definitions of feeding stuffs, etc. Most of the material is also given in revised form in the bulletin noted above.

Feeding ground rough rice, etc., to horses, mules, hogs, and dairy cattle, W. H. Dalrymple et al. (*Louisiana Stas. Bul. 179 (1921), pp. 8*).—To show that rough rice and brewers' rice can be fed to live stock without injurious results, feeding experiments with hogs and dairy cows are reported, and the mule feeding experiments reported in Bulletin 122 (E. S. R., 23, p. 672) are reviewed.

In the hog feeding test, which was conducted by E. L. Jordan, A. F. Kidder, and L. E. Long, there were 6 groups of 3 shotes each and the feeding period lasted 42 days. The 2 groups receiving the check ration of corn meal and tankage made an average daily gain per head of 2.04 lbs. The feeds given each of the other groups and the average daily gains per head were as follows: Ground rough rice and tankage, 1.86 lbs.; ground rough rice, corn meal, and tankage, 2.19 lbs.; brewers' rice and tankage, 2.05 lbs.; and brewers' rice, corn meal, and tankage, 2.3 lbs. Post-mortem examination showed that the consumption of large quantities of the rice did not produce any injury to the digestive organs.

The experiment with dairy cows was conducted by R. C. Calloway and involved 2 lots of 6 cows each. The control group, which was fed a ration of corn meal, bran, and cottonseed meal, averaged 24.5 lbs. of milk per day during the 60 days of the experiment. The other group was fed ground rough rice and cottonseed meal and averaged 22.5 lbs. of milk. The second mixture was apparently not so palatable as the first, but no injurious effects were observed although the rice formed 80 per cent of the grain mixture.

Prickly pear as a fodder for stock, C. F. JURITZ (*Union So. Africa Dept. Agr., Sci. Bul. 16 (1920), pp. 15*).—This is a compilation of published and hitherto unpublished analyses of the stems, fruits, etc., of *Opuntia* spp., together with suggestions for feeding these materials to stock. There is a bibliography of 25 titles.

Influence of winter rations on the growth of steers on pasture, E. W. SHEETS (*U. S. Dept. Agr., Dept. Circ. 166 (1921), pp. 11, figs. 4*).—The results of the experiments previously noted from Department Bulletin 870 (E. S. R., 44, p. 176) are here summarized, mainly in the form of graphs.

Feeding yearling steers, C. E. STOCKDALE (*West Virginia Sta. Circ. 34 (1921), pp. 4, fig. 1*).—This is a more brief summary of the results noted above.

The inheritance of the muzzle color in the cattle breed of Stjernsund, H. FUNKQUIST (*Hereditas, 1 (1920), No. 3, pp. 343–363, figs. 3*).—This is a compilation of a large number of herdbook records of the color of the rhinarium in the Stjernsund breed of cattle. Since in some cases parents with flesh-colored muzzles produced offspring with dark muzzles, and in others individuals with flesh-colored muzzles were descended from two dark-muzzled parents, it is concluded that at least two factors, *G* and *P*, are responsible for muzzle color. *G* produces flesh color and *P* in the absence of *G* produces pigmented muzzle. The phenotype *gp* represents the recessive flesh-colored muzzle. The suggestion is also made that there is a second *P* gene (P_1), and that the two are duplicate genes. Individuals with spotted or mixed muzzles are thought to have the formula $ggPpp_1p_1$ or $ggppP_1p_1$.

Grain sorghums v. corn for fattening lambs, J. M. JONES, R. A. BREWER, and R. E. DICKSON (*Texas Sta. Bul. 269 (1920), pp. 3–13*).—A 95-day feeding experiment in the winter of 1919–20 with 6 lots of 20 59-lb. lambs is reported. Each lamb received an average ration of 1.08 lbs. of grain, 0.14 lb. of cottonseed meal, and 1.89 lbs. of alfalfa hay. The grains fed in the different lots and the average daily gain per lamb were as follows: Ground corn (as a check), 0.393 lb.; ground milo, 0.394 lb.; ground milo heads, 0.362 lb.; ground feterita, 0.36 lb.; ground feterita heads, 0.339 lb.; and ground kafir, 0.372 lb. The lot fed milo required 3.1 lbs. of concentrates and 4.81 lbs. of alfalfa per pound of gain.

Analyses of the feeds offered and determinations of the Fraps productive (fat) values (E. S. R., 35, p. 561) are included.

Field peas for fattening lambs, T. W. LONSDALE (*New Zeal. Jour. Agr., 21 (1920), No. 3, p. 140*).—At the Moumahaki Experimental Farm a lot of 59-lb. lambs on rape pasture gained 9.41 lbs. per head in 3 weeks, while a similar lot of 56-lb. lambs on an equal area of field pea pasture, seeded the same day as the rape, gained 12.68 lbs. per head.

Studies on the Münchenlohra flock of Merino mutton sheep, C. OHLY (*Arb. Deut. Gesell. Züchtungsk., No. 24 (1920), pp. 110, pls. 9*).—This is an account of a large sheep ranch established about 1863. The foundation stock consisted of French Merinos, and the flock, like a similar one described by Schmehl (E. S. R., 28, p. 366), has been maintained by intensive inbreeding from which no ill effects have come. A history of Merino breeding in Germany during the early part of the nineteenth century is included.

Annual wool review for 1919 and 1920, J. B. MCPHERSON (*Bul. Natl. Assoc. Wool Manfrs., 50 (1920), No. 1, pp. 34–115, pl. 1; 51 (1921), No. 1, pp. 29–114, pls. 4*).—These are the customary yearly reports giving statistics of domestic wool production and the wool trade of the United States and other countries, and are similar to those formerly prepared by Battison (E. S. R., 42, p. 770).

The reindeer industry in Alaska, G. J. Lomen (*Jour. Heredity, 11 (1920), No. 6, pp. 243–252, pl. 1, figs. 9*).—The author describes the growth of the reindeer industry in Alaska since the first importations from Siberia in 1892.

Swine [feeding in Guam], C. W. Edwards (*Guam Sta. Rpt. 1919, pp. 13–16, fig. 1*).—Two lots of 4 pigs each were used in a study of the tethering method practiced by the Chamorro farmers in feeding their pigs. The lot kept tethered made a total gain of only 43 lbs. during the four months of the experiment, whereas the lot with a free range of Para grass pasture gained 144.5 lbs. although they were given only as much concentrate feed as the tethered lot consumed.

In an experiment with growing swine 4 native pigs were fed a ration composed of corn meal, ground cowpeas, and cooked sweet potatoes (characteristic native feeds) and made a total gain of 121 lbs. in the 60 days of the test. Another lot fed corn meal, ground oats, and meat scrap gained only 96 lbs. in the same period.

A progress report is included of studies of velvet beans as a feed for brood sows.

The rate of ovulation in the domestic fowl during the pullet year, S. Brody (*Jour. Gen. Physiol., 3 (1921), No. 4, pp. 431–437, fig. 1*).—This contribution from the Missouri Experiment Station is an attempt to express egg production by the mathematical formula for an autocatalytic monomolecular reaction employed by Robertson (E. S. R., 36, p. 263) and others to estimate the rate of growth of animals and plants. The formula in the form here used is

$$\log\frac{x}{A-x}=K\,(t-t_1),$$

where A is the number of eggs laid in the natural laying season, x is the number of eggs laid from the beginning of this season to time t, t_1 is the time required to produce the first half of the eggs laid during the season, and K is a constant to be determined from the data at hand. Since egg records are usually tabulated by months from November to October, A is assumed equal to the number of eggs laid in this period, and t and t_1 are measured in months with origin at November 1.

For the 4,210 Barred Plymouth Rock pullets discussed by Pearl and Surface (E. S. R., 24, p. 675), $A=129$ eggs, $t_1=5.9$ months, and $K=0.212$. For 1,000 White Leghorn pullets at the Storrs egg laying contests (E. S. R., 41, p. 870), $A=163$ eggs, $t_1=6.64$ months, and $K=0.235$. Tabulations are presented showing the concordance between the actual and the computed egg records for the two sets of data. The agreement was particularly good from January to August. Discrepancies in the other months are attributed mainly to the failure of the natural laying season to coincide with the calendar year.

Elements of higher fecundity, M. E. Dickson (*Mich. Acad. Sci. Ann. Rpt., 21 (1919), pp. 145, 146*).—Records of egg-laying tests are cited to show that there is little difference between breeds in average egg records per hen. This result is attributed to the uniformity of conditions at contests and is held to demonstrate the futility of breeding for egg production.

Mineral content of southern poultry feeds and of other feed mixtures and their potential acidity and potential alkalinity, B. F. Kaupp (*N. C. Dept. Agr. Bul., 41 (1920), No. 17 [North Carolina Sta. Tech. Bul. 19] pp. 42, fig. 1*).—This consists of material in two papers previously noted (E. S. R., 39, p. 577; 44, p. 473).

[Poultry feeding experiments in Guam], C. W. Edwards (*Guam Sta. Rpt. 1919, pp. 19, 20*).—In a study of hand-squeezed fresh grated coconut as a supplement to a ration of wheat, corn, oats, and cowpeas for chicks under six weeks of age, it was found that chicks receiving the coconut to the extent of 20 or 30 per cent of the ration grew more rapidly than the check lot not receiving the coconut and showed no ill effects. There was some indication that the use of a higher proportion of coconut produced paralysis, but the lot receiving the coconut to the extent of 75 per cent of the ration did not show a higher mortality than the check lot.

Two tests of rations composed of local feeds were made with chicks from 6 to 12 weeks old. One ration was composed of cracked corn, cracked rice, cracked cowpeas, hand-squeezed coconut, and meat scrap, and the other of cracked corn, hand-squeezed coconut, and meat scrap. In neither case were the gains as great as those produced by a so-called imported ration in which the mash was composed of corn meal, bran, and meat scrap and the scratch feed of corn, wheat, and oats.

Poultry feeding: Meat v. no meat, F. C. Brown (*New Zeal. Jour. Agr., 21 (1920), No. 3, pp. 136, 137*).—Two pens of six White Leghorn pullets receiving only wheat (whole and ground), shorts, and bran for a year produced, respectively, 209.5 and 215.7 eggs per bird, and two other hens receiving meat meal in addition laid 247 and 267.5 eggs per bird.

Effect of lights on common flock, B. F. Kaupp (*Poultry Item, 23 (1921), No. 3, pp. 7–9, fig. 1*).—A pen of 31 Single Comb Rhode Island Red pullets at the North Carolina Experiment Station, which was lighted artificially during the winter so as to make the daily feeding period 15 hours, averaged 147 eggs per bird during the year (1919–20). A similar flock not lighted averaged 104.8 eggs. The former required 7.1 lbs. of feed per dozen eggs and the latter 9.6 lbs.

Coal stove colony brooding, I. L. Owen (*New Jersey Stas., Hints to Poultrymen, 9 (1921), No. 6, pp. 4, figs. 4*).—Brief popular information is given on colony brooding using a coal-burning stove for heating.

Management of chickens on Texas farms, R. M. Sherwood (*Texas Sta. Circ. 25 (1921), pp. 3–14, figs. 5*).—Suggestions for the selection of breeding stock, the hatching and care of chicks, and the feeding and housing of laying hens are included.

Poultry keeping in the Federated Malay States, H. M. Miller (*Utility Poultry Jour., 5 (1920), No. 6, p. 257*).—In this brief note the author states that the native fowl are mainly of the game type, but that European breeds have been imported and seem to thrive. Paddy is the principal feed used, but other local feeds available are maize, punace (coconut waste after oil extraction), and rubber seeds split and boiled. The author feeds a wet mash composed of ground paddy husks, punace, and boiled tapioca root.

DAIRY FARMING—DAIRYING.

Can "home grown rations" supply proteins of adequate quality and quantity for high milk production? II, E. B. Hart and G. C. Humphrey (*Jour. Biol. Chem., 44 (1920), No. 1, pp. 189–201, figs. 3*).—The authors report a repetition of their previous experiment (E. S. R., 43, p. 270), using alfalfa hay in place of red clover hay. The rations were made up so that each 50 lbs. provided 250 gm. of nitrogen, and the nutritive ratio was approximately 1 : 7.9. All four cows maintained a positive nitrogen balance and maintained their milk flow at its normal level. One of the cows was a Holstein giving 40 to 45 lbs. of milk daily, containing 11.4 per cent of solids.

The difference between these results and those secured with red clover are not attributed to any peculiarity of the alfalfa proteins, but to the fact that alfalfa hay, having a higher protein content, permits a larger intake of nitrogen. In each experiment about the same proportion of digested nitrogen was used for productive purposes.

Sunflower ensilage, W. C. McKillican (*Farmer's Advocate and Home Jour., 56 (1921), No. 1493, pp. 632, 633*).—The milk records of 7 Milking Shorthorn cows at the Brandon, Manitoba, Experimental Farm during three 3-week periods are summarized. The ration consisted of 10 lbs. of grain, 45 lbs. of silage, 25 lbs. of mangels, and 12 lbs. of straw. Sunflower silage was fed in periods 1 and 3, and the daily milk yields were, respectively, 24.62 and 21.37 lbs. per cow. During the second period, when corn silage was fed, the yield was 23.59 lbs. In the case of each cow the yield during period 2 was greater than the average during periods 1 and 3, the mean difference being 0.59 lb.

It was noticed that abnormally large amounts of urine were discharged during the feeding of sunflower silage, but no injurious effects were observed. The sunflower silage froze more readily than the corn silage, although the moisture content was not higher.

A study in bulls, A. C. McCandlish and L. M. Winters (*Jour. Dairy Sci., 3 (1920), No. 6, pp. 529–539*).—This is the study of the milk and butter fat production of the daughters of five herd sires used at the Iowa State College dairy farm in comparison with the yields of the daughters' dams. The records in each case are corrected to a standard mature age. Two of the bulls produced a distinct increase in records and one a distinct decrease.

Ad interim report on milk production, J. O'Neill, D. Figgis, et al. (*Dublin: Comn. Inq. into Resources and Indus. Ireland, 1920, pp. 24*).—This is a preliminary report of a survey of the status of milk production in Ireland based upon an extensive body of testimony presented by witnesses.

It was found that the annual milk production averaged only about 420 gal. per cow and that many cows gave less than 200 gal. The speedy organization of cow test associations is advocated, part of the expense of operation to be borne by the local creameries. Pending this, it is suggested that the creamery manager keep what records he can of the average production on individual farms. It is also suggested that stud farms be established in dairy districts where bulls of the best dairy strains can be tested in respect to their transmitting qualities. If the progeny prove satisfactory the bulls are to be available for service to neighboring farmers.

Bacterial inhibition.—I, Germicidal action in milk, W. H. Chambers (*Jour. Bact., 5 (1920), No. 6, pp. 527–541, figs. 4*).—The author reports experiments made at the Illinois Experiment Station in which samples of milk were inoculated with pure cultures of *Bacterium coli*, *B. lactis-acidi*, and an unidentified red chromogen isolated from a creamery can. The milks were obtained under aseptic conditions from 11 cows selected because in previous experiments they had shown a low germ content in the udder. Half of each sample was inoculated raw and was held at 37° C., while the other half was heated to 85 or 90° for 2 minutes and then cooled to 37°.

From a comparison of the accounts of the organisms in the raw and in the heated milk it was found that the raw milk had a marked germicidal effect upon *B. coli*, only a slight effect (if any) on the chromogen, and a somewhat accelerating effect on the growth of *B. lactis-acidi*. The germicidal action depended somewhat upon the individual cow. Since the chromogen and the *B. lactis-acidi* showed considerable clumping in the raw milk cultures and *B. coli* showed but little clumping, it is concluded that there is no common relation between agglutination and bacterial inhibition except that both are destroyed by heating the milk.

The sporogenes test as an index of the contamination of milk, S. H. AYERS and P. W. CLEMMER (*U. S. Dept. Agr. Bul. 940 (1921), pp. 20, pls. 8*).—In experiments made in the Dairy Division neither the original Savage test (E. S. R., 25, p. 877) nor the Weinzirl-Veldee test (E. S. R., 34, p. 272) gave results which were of quantitative value in estimating the contamination of milk with *Bacillus enteritidis sporogenes*. A modification of the Savage method in which each of the 10 tubes is filled with 20 cc. of the sample instead of 2 cc. proved fairly satisfactory. Experiments also showed that dirty utensils do not contaminate milk with spores of *B. enteritidis sporogenes*, and that the only important sources of the spores is manure.

Detection of manurial pollution in milk by the anaerobic spore test, J. WEINZIRL (*Amer. Jour. Pub. Health, 11 (1921), No. 2, pp. 149–152, fig. 1*).—This paper supplements that of Weinzirl and Veldee (E. S. R., 34, p. 272). Since *Bacillus sporogenes* is not the only anaerobe present in cow manure, the name "*B. sporogenes* test" is abandoned and "anaerobic spore test" substituted. A single test tube containing 5 cc. of the sample is now used in place of the three tubes formerly employed.

It was found that about 25 per cent of the market milk of Seattle and Yakima, Wash., gave evidence of manurial pollution.

Pure culture starter for butter making, A. T. CHARRON (*Quebec Min. Agr. Rpt., 1920, pp. 64–67*).—In an experiment at the Provincial Dairy School, St. Hyacinthe, Quebec, 14 samples of pasteurized cream were churned without starter and 15 with starter. Competent judges who scored the butter for flavor at intervals during storage were unable to detect any superiority in the butter made with starter.

The gas production of Streptococcus kefir, J. M. SHERMAN (*Jour. Bact., 6 (1921), No. 1, pp. 127–131*).—The cultures of *S. kefir* isolated from Cheddar cheese by Evans (E. S. R., 39, p. 385) were studied in the laboratories of the Dairy Division, U. S. Department of Agriculture. The author's observations indicated that this organism utilizes the lactose but not the peptone of lactose broth to produce carbon dioxid. Since carbon dioxid production in Cheddar cheese continues long after the disappearance of the lactose, it is concluded that relatively little of the gas produced during curing can be attributed to *S. kefir*.

VETERINARY MEDICINE.

The importance of research in animal pathology to agriculture, T. SMITH (*Nebr. Univ., Agr. Col. [Pamphlet], 1920, pp. 23*).—This is an address given at the dedication of the animal pathology and hygiene laboratories of the University of Nebraska in September, 1920.

Proceedings of the Ohio State Veterinary Medical Association, 1919 (*Ohio Vet. Med. Assoc. Proc., 1919, pp. 153*).—Included in the proceedings are the following papers: The Pathology of the Reproductive Organs in Sterility, by E. T. Hallman (pp. 109–114); Hemorrhagic Septicemia in Swine, by E. A. Cahill (pp. 115–121); Some New Surgical Methods, Illustrated, by N. S. Mayo (pp. 122, 123); Tuberculosis Eradication, by J. E. Gibson (pp. 124–135); Stomach and Intestinal Ailments of Ruminants, Therapeutical Advice, by F. L. Carr (pp. 136–141); A Report of Anthelmintic Experiments Conducted at the Ohio Experiment Station, by D. C. Mote (pp. 142–147); and Observations in the Control of Contagious Abortion of Cattle, by C. W. Eddy (pp. 148–153).

Annual reports of the official veterinarians of Prussia for 1912 and 1913, NEVERMANN (*Veröffentl. Jahres-Vet. Ber. Tierärzte Preuss., 13 (1912 [pub. 1914]), pt. 1, pp. VI+156, pls. 16, figs. 1; 13 (1912 [pub. 1920]), pt. 2, pp.*

IV+143; 14 (1913 [pub. 1920]), pt. 1, pp. VI+115, pls. 4).—These are the thirteenth and the first part of the fourteenth annual reports dealing with animal diseases in Prussia in 1912 and 1913, with the statistical data presented in tabular form (E. S. R., 32, p. 577).

Comparative studies on the physiological value and toxicity of cotton seed and some of its products, I. G. Macy and L. B. Mendel (*Jour. Pharmacol. and Expt. Ther., 16 (1920), No. 5, pp. 345–390, figs. 22*).—"Cotton seed kernels, alone or mixed with other foodstuffs, are unpalatable and fatally toxic to rabbits, guinea pigs, and pigeons even when fed with molasses and cabbage; and also to albino mice even when the kernels are supplemented with butter fat and inorganic salts. Rabbits and guinea pigs decline rapidly on cottonseed meal; pigeons and mice decline more slowly, depending upon the source and properties of the meal fed; for different samples of cottonseed meal vary in their immediate effects upon animals. Cottonseed meal was rendered less deleterious and more palatable to rabbits by treatment with moist heat at high temperatures. Thorough extraction with ether was ineffective in detoxicating cottonseed meal.

"The decline of animals feeding on cottonseed meal, resulting in the so-called 'cottonseed meal injury,' is not attributable entirely to inanition. This was demonstrated by determining the food intake of each animal and by conducting control experiments; the latter, in which animals received daily the same quantity of an adequate control diet as that which the cottonseed meal victims consumed, show that death is not the result of starvation, but due to some other factor.

"Cottonseed meal injury is not due to a lack of water-soluble vitamin, first, because all cottonseed diets were fed to rabbits, guinea pigs, and pigeons along with a large quantity of cabbage which is well known to contain sufficient vitamins; secondly, because mice survived six months in good condition on a diet in which the only source of water-soluble vitamin was cottonseed meal; thirdly, because toxic cottonseed meal contains enough vitamin to completely relieve pigeons suffering from polyneuritis in two to five days; fourthly, because yeast, which is very rich in water-soluble vitamin, incorporated in a toxic cottonseed meal diet is ineffective in warding off cottonseed meal injury.

"Some animals are able to recover from the ill effects of cottonseed diets when the deleterious food is replaced by an adequate one, others are not.

"Normal reproduction of albino mice does not take place on a food mixture containing 50 per cent cottonseed meal, 5 per cent butter fat, 4 per cent inorganic salt mixture—a diet which one would regard as adequate; the second generation tends to be very weak and unable to reproduce in the normal way.

"The most characteristic clinical symptoms of cottonseed meal injury in rabbits, guinea pigs, pigeons, and albino mice are emaciation, loss of appetite, weakness, rough hair and unkempt appearance, disturbance in breathing, finally coma and perhaps paralysis. Macroscopic post-mortem examination reveals dilation of the right side of the heart, and usually congestion of the liver, kidneys, and in many cases, the lungs. Splanchnic congestion was frequent, and if the intestines were not hermorrhagic they often appeared friable and easily ruptured."

On the classification of the Ascaridae, II, H. A. Baylis (*Parasitology, 12 (1920), No. 4, pp. 411–426, figs. 7*).—The second part of this paper, the first part of which has been previously noted (E. S. R., 44, p. 375), deals with the Polydelphis group, with some account of other ascarids parasitic in snakes.

Experimental investigation of the bactericidal action of metals (copper and silver) in vivo, T. Matsunaga (*Centbl. Bakt. [etc.], 1. Abt., Orig., 82*

(1918), No. 3–4, pp. 311–317).—Powdered silver or copper, when injected subcutaneously into guinea pigs together with various pathogenic organisms, was found to inhibit the growth of these organisms. Good results were obtained with anthrax, diphtheria, and tetanus bacilli. The author is of the opinion that these results, together with similar results obtained by others in vitro, indicate the possible value of powdered metals in wound treatment.

Investigation of specific disinfectants.—II, The action of salts and ions on bacteria, P. Eisenberg *(Centbl. Bakt. [etc.], 1. Abt., Orig., 82 (1918), No. 2, pp. 69–208)*.—This extensive investigation is in continuation of a previous study[1] in which it was shown that the action of many anilin dyes, both basic and acid, on various microorganisms was selective in that the Gram-positive were much more easily destroyed than the Gram-negative. In an effort to discover the relation between chemical constitution and bactericidal action, the antiseptic and bactericidal action of a large number of inorganic salts was tested on a number of bacteria by the methods employed in the previous study. The results obtained are presented in a series of tables indicating the relative effect on the 12 organisms studied of different positive and negative ions.

Comparative study of new substitutes for saponified cresol solutions, F. Ditthorn *(Centbl. Bakt. [etc.], 1. Abt., Orig., 82 (1918), No. 6, pp. 477–483)*.—A study is reported of the relative solubility and bactericidal action of six commercial substitutes for cresol, Fawestol, Cresotin Cresol, Betalysol, Cresolit, Opticreso, and Tricresol. All were found to have strong bactericidal power in concentrations furnishing from 1 to 2 per cent of cresol.

Some new disinfectants, F. Ditthorn *(Centbl. Bakt. [etc.], 1. Abt., Orig., 84 (1920), No. 6, pp. 486–496)*.—Continuing the examination of substitutes for cresol soap solutions noted above, the author reports the results of a study of the relative bactericidal power of the following commercial preparations: Tetosol, Cresitol, and Caral A (cresol with a cresol soap solution), Parol and Caral B (chlorcresols), Optiform and Caral C (formalin soap preparations), and Kentausan (a cresol formaldehyde preparation).

The disinfecting value of the three cresol isomers (meta-, ortho-, and paracresol), F. Ditthorn *(Centbl. Bakt. [etc.], 1. Abt., Orig., 82 (1918), No. 6, pp. 483–491)*.—The relative bactericidal powers of the three isomeric forms of cresol were found to be in the decreasing order of the meta, para, and ortho compounds. So little difference was, however, noted in their strength that the practice of preparing an ortho-free cresol is thought inadvisable, and a mixture of the three is instead recommended as having a stronger action than any one isomer alone.

Insoluble serum, A. Besredka *(Compt. Rend. Soc. Biol. [Paris], 83 (1920), No. 13, pp. 467, 468)*.—The author states that by dissolving desiccated serum (5 gm.) in 10 cc. of physiological salt solution and heating the solution on the water bath for an hour at from 57 to 58° C. a yellow, transparent mass of coagulated serum is obtained which retains all its original properties except solubility. By triturating the powder in water or a very dilute phenol solution, an emulsion is obtained which can be used in place of ordinary serum for intratracheal injections and is said to have the advantage, owing to its insolubility, of offering no danger to an animal in a state of anaphylaxis. Intravenous injection is to be avoided on account of the possibility of embolism.

Attempts at purification of therapeutic sera, A. Besredka *(Compt. Rend. Acad. Sci. [Paris], 170 (1920), No. 26, pp. 1628, 1629)*.—The emulsion of solidified serum noted above has been found to separate on standing for 24 hours into two layers, the lower a yellowish turbid liquid containing the protein matter and the upper a transparent limpid liquid which, on evaporation in vacuo, gives a residue equal to one-tenth of the original serum. This liquid is even less toxic for the sensitized animal than the total serum, and can be injected directly into the blood in doses of 1 cc. or more without provoking anaphylactic symptoms. Experiments with antitetanus serum prepared in this way have indicated that the antibodies are concentrated in this liquid.

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[1] Centbl. Bakt. [etc.], 1. Abt., Orig., 71 (1913), No. 5–7, pp. 420–503.

Epidermoid carcinoma in domesticated animals, S. A. Goldberg (*Cornell Vet., 10 (1920), No. 4, pp. 235–244, pls. 5*).—A review of the literature and the cases here reported have led the author to conclude that (1) in the domestic animals the epidermoid carcinomas are the most common of the malignant epithelial tumors, and (2) epidermoid carcinoma originates more frequently at the places of transition between the skin and modified squamous epithelium, or between squamous and other types of epithelium.

The artificial transmission of foot-and-mouth disease to guinea pigs, O. Waldmann and J. Pape (*Berlin. Tierärztl. Wchnschr., 36 (1920), No. 44, pp. 519, 520*).—The authors report that they have succeeded in transmitting foot-and-mouth disease from swine to guinea pigs by subcutaneous inoculation of virus from a fresh lesion. From the typical lesions produced transfers have been made through five generations. In explaining the failure of previous workers to infect guinea pigs with foot-and-mouth disease, they suggest that the disease in the present epidemic may have been of an unusually high virulence or that the virus may have become so altered through successive swine passages as to be more suitable for guinea pig inoculation.

The detection of glanders in exhumed carcasses by means of the precipitation method, W. Pfeiler and A. Rehse (*Centbl. Bakt.* [*etc.*], *1. Abt., Orig., 82 (1918), No. 3–4, pp. 240–242*).—The author reviews the conflicting literature on the reliability of the precipitation test for diagnosing glanders in exhumed carcasses, and reports three cases in which positive results were obtained with this reaction while other methods failed.

Immunization with bile against rinderpest, Curasson (*Bul. Soc. Cent. Méd. Vét., 96 (1920), No. 8–10, pp. 142–145*).—The author reports considerable experience in the French Sudan in the immunization of cattle against rinderpest by means of bile from animals affected with the disease. A high percentage mortality resulted following inoculation with bile from animals having a virulent form of the disease, but a low percentage mortality following inoculation with bile from animals having only a slight attack. The inoculation thus produces an attack of the disease, mild or severe, according to the nature of the bile used, and does not confer a state of active or passive immunity in the usual sense of the word.

Chemical composition of the tubercle bacillus (*Ann. Inst. Pasteur, 34 (1920), No. 8, pp. 497–546*).—This extensive study of the chemical composition of the tubercle bacillus is presented in three parts, as follows:

I. *The organic composition of the tubercle bacillus*, A. Goris (pp. 497–533).—The literature on this phase of the study is reviewed and discussed under the headings of researches on the extraction of the organic constituents of the bacillus, particularly fats, and analytical study of these constituents. This is followed by the report of the author's investigations following the same general scheme, the material used being a mixture of human and bovine tubercle bacilli such as is used at the Pasteur Institute in the preparation of tuberculin. The results of this study are summarized as follows:

The lipoid constituents of the tubercle bacillus include a new substance of the nature of an ester soluble in chloroform and insoluble in ordinary ether, and forming on hydrolysis crotonic acid mixed with a little isocrotonic acid. On account of its transparent appearance the ester has been given the name "hyalinol." Other constituents found were a waxy phosphatid-containing mixture, giving on hydrolysis mycol, another alcohol of high molecular weight, and a mixture of palmitic and stearic acids; a wax consisting principally of mycol laurate, a substance melting at 300° C. but obtained in too small quantities to be studied; and a fat consisting essentially of the glycerids of oleic, palmitic stearic; and arachidic acids with a small quantity of caproic and butyric acids. Among the nonlipoidal substances were found a nucleoprotein giving reactions analogous to but less marked than tuberculin and amino acids resulting from the digestion of protein matter by the bacillus.

II. *Inorganic constituents of the tubercle bacillus*, A. Goris and A. Liot (pp. 533-537).—The tubercle bacilli yielded about 2.5 per cent of ash consisting chiefly of phosphates with some sulphates. The metals in decreasing order consisted of sodium, potassium, calcium, and magnesium, with traces of iron, manganese, and zinc, the last element being considered accidental.

III. *Study of acid resistance*, A. Goris and A. Liot (pp. 537-545).—The acid resistance of the tubercle bacillus was found to be due chiefly to certain of the lipoidal substances with which it is impregnated, the most active substances being the waxes, together with the free alcohol liberated with their saponification.

Serum diagnosis of tuberculosis with the antigen of Besredka, A. Bass (*Compt. Rend. Soc. Biol. [Paris], 83 (1920), No. 28, pp. 1261, 1262*).—In the experience of the author the complement fixation test for tuberculosis is always positive in confirmed tuberculosis and always negative in healthy subjects, while ~~in~~ doubtful cases a negative reaction indicates absence of lesions.

Improper tuberculin tests, J. R. Mohler (*Cornell Vet., 10 (1920), No. 4, pp. 229-234*).

Tuberculosis literature in France during 1914-1919, G. Ichok (*Internatl. Centbl. Gesam. Tuberkulose Forsch., 14 (1920), No. 10-12, pp. 195-228*).—This is a condensed review of French contributions to the study of tuberculosis, with many references to the original literature.

On some filariid parasites of cattle and other ruminants, C. L. Boulenger (*Parasitology, 12 (1920), No. 4, pp. 341-349, figs. 7*).—Descriptions are given of *Setaria labiato-papillosa* (Aless.), *S. digitata* (v. Linst.), *S. marshalli* n. sp., and *S. hornbyi* n. sp.

Pseudo-actinomycosis or streptotrichosis in the camel, F. E. Mason (*Agr. Jour. Egypt, 9 (1919), pp. 7-13, pls. 2*).—The author fails to find any previous record of streptotrichosis in the camel, nor of any streptothrix having the peculiar characters of the form here described as new under the name *Streptothrix cameli.*

Diseases of swine, W. W. Dimock (*Vet. Alumni Quart. [Ohio State Univ.], 8 (1920), No. 2, pp. 37-45*).—This is a general discussion of the classification, diagnosis, and methods of control of diseases of swine as they concern the practitioner.

Infectious abortion in sows, F. M. Hayes and J. Traum (*Duroc Digest, 3 (1920), No. 2, pp. 44, 45*).—This is a brief discussion of the symptoms of contagious abortion in swine, interpretations of reaction to the agglutination test, methods of drawing and shipping the blood for the test, and precautions to be taken toward the prevention of the disease.

The turkey an important factor in the spread of gapeworms, B. H. Ransom (*U. S. Dept. Agr. Bul. 939 (1921), pp. 13*).—In examinations made of the tracheas of 635 chickens that were killed for sale at poultry stalls in Washington, D. C., during the winter months, none of which fowls were less than 6 months old, no infestation with *Syngamus trachealis* was detected. Tracheas of 679 turkeys from the same market, all of which birds were at least 6 months old, gave an infestation of 22.5 per cent.

In artificial infestation experiments in which gapeworm eggs containing fully developed larvae were fed to incubator chickens, there resulted an infestation of 87 per cent in chickens up to the age of 4 weeks, 84 per cent from 5 to 8 weeks of age, 66 per cent from 9 to 20 weeks of age, and 29 per cent from 21 weeks to adult age.

The investigations reported led the author to conclude that the turkey is probably the natural host of the gapeworm, and that adult as well as young turkeys commonly harbor gapeworms, though they may show no symptoms of infestation. "The turkey is apparently the chief agent in the spread of gapeworms to new localities and is apparently the principal source of infection to the soil on poultry farms where gapes is prevalent. Gapes among chickens appears to be more prevalent on farms where turkeys frequent the chicken runs than on farms where there are no turkeys. Available evidence indicates that gapes has a tendency to disappear from farms following the removal of turkeys.

"Chickens, unlike turkeys, are readily susceptible to infection with gapeworms only while they are young. They become less susceptible to infection as they grow older. Adult chickens, at least in some localities, rarely harbor gapeworms, and hence in such localities are seldom likely to spread infection. In those instances in which gapeworms develop in adult chickens or chickens approaching maturity, the parasites are likely to live only a short time.

"Ground contaminated by gapeworms is likely to remain infective for at least a year after further infection of the soil has ceased. Losses from gapes can be greatly reduced, if not altogether avoided, by keeping young chickens on ground that has not been exposed to contamination within at least a year and that is protected from further contamination by excluding turkeys from it during its occupancy by the chickens. As gapeworms appear rarely to occur in adult chickens, brood hens may be associated with the young chickens with probably little risk of infection to the latter from that source. The simplest means of preventing or reducing losses from gapes appears to be the exclusion of turkeys from farms where chickens are raised."

Sod disease of chickens (vesicular dermatitis), I. E. Newsom and W. H. Feldman (*Colorado Sta. Bul. 262 (1920), pp. 12, figs. 6*).—This is an account of an affection, largely of small chicks during the first month of life, that has not been previously described. In some cases old hens are also affected. The station has been receiving requests for information concerning the disease for the past 7 or 8 years, and it has been observed by one party at Elba, Colo., practically every year for the past 13 years. Observations indicate that it is quite prevalent throughout all of Colorado east of the Rocky Mountains wherever prairie sod remains unbroken, but it has not been reported from the western slope of the State. It appears to be fairly well known in western Kansas and Nebraska and in eastern Wyoming. In some localities it is so serious as to cause settlers to stop raising chickens entirely, and in several instances it has resulted in the loss of from 50 to 90 per cent of all young chickens. It has also been the experience of some that the disease is extremely virulent in certain years, only to disappear entirely in the year succeeding, though there is no evidence that it is associated with either dry or wet years.

The disease frequently becomes apparent during the first week of life, the young chicken becoming dull and remaining behind the rest of the brood. Close examination at this time often reveals the presence of blisters between the toes or possibly small scabs on top of the toes and on the lower part of the leg. "Scabs have not been found on the under surface of the toe. The whole foot is usually swollen and is very tender to the touch. Owing to the pain, the chicken sits down a great deal. In the course of two or three days the vesicle ruptures and is replaced by a thick, heavy scab. The toes increase in size and become very rigid. Occasionally a joint or even a whole toe drops off. If the chicken survives the scabs disappear in the course of two or three weeks longer, and the toes become extremely distorted, turning usually in an upward direction so that the only portion of the foot that touches the ground is the heel. During the scabby stage, chickens pick at the feet a great deal.

"The symptoms may or may not appear on the head, and in some instances they may show on the head and not on the feet. In the early stages small vesicles may be found in the unfeathered skin around the bill and around the eyes. These are followed by considerable swelling, increasing redness, and later by the presence of scabs. Often the eyelids become glued together and the chicken becomes totally blind. It appears that many chickens starve in this stage because of inability to find food. Older chickens are not nearly so frequently affected, but when the disease does attack them it produces similar conditions of the feet and shows considerable swelling around the eyes, with rather extreme redness. Vesicles have not been noted in hens, it requiring from one to two weeks in most instances for the disease to prove fatal, whereas in small chickens the disease may terminate fatally in one or two days.

"The flock mortality may run as high as 90 per cent in virulent outbreaks. Generally, however, it will not average above 20 per cent. Most of the affected birds die, and the rest are practically worthless, since they become stunted and their feet are so distorted that they can not get around readily. As a consequence they are frequently destroyed, even though they appear to recover from the acute symptoms of the disease. Therefore, it may safely be said that of the chickens which are affected the loss is practically 100 per cent."

The disease is more apt to be mistaken for roup than any other malady, but can easily be differentiated, since roup is largely a cold weather disease and sod disease appears in summer. Again, sod disease affects more especially small chickens, whereas roup, appearing in the winter time, is more likely to be a disease of adults. The inflammatory disturbance in sod disease seems to be confined to the skin, whereas in roup it is more apt to be due to accumulation within the maxillary sinus. While the comb and wattles may become scabby, they are not warty as in contagious epithelioma. Bumble foot may be differentiated, since it is usually an inflammatory condition of the deeper structures and is seldom associated with the presence of scabs on the upper surface of the toes. Scaly leg may be differentiated by finding the mites and also by the fact that it is largely a disease of the leg instead of the toe.

While the disease is suspected of being infectious, investigations have failed to give any support to the supposition. Studies have shown the disease to be associated with sod, having never been known on irrigated land, nor does it occur on dry land where the sod has been broken up and the fields have been cultivated for a few years, but it does occur in irrigated districts in places where the chickens have the run of sod above the irrigating ditch.

Dipping the affected parts in kerosene oil appears to have been the most effective and practical means of treatment, being especially reliable for older chickens where the disease is more chronic. No treatment, however, seems to be of much avail in very young birds. As a means of prevention it is recommended that chickens be confined to plowed ground.

A micrococcus infection of chicks, H. B. GOODALE (*Jour. Amer. Assoc. Instr. and Invest. Poultry Husb., 5 (1919), No. 8, p. 64*).—Post-mortem examinations of chicks, which had shown very few symptoms except poor growth prior to their death, resulted in finding that the lungs were congested or filled with whitish nodules. Although such nodules are usually considered diagnostic of infection with Aspergillus, only numerous cocci, identified as probably *Micrococcus tetragenus*, were found. In one lot about 50 per cent of the chicks died, while the rest were greatly retarded in growth. The litter, although it was clean and good, was apparently the source of the infection, since *M. tetragenus* is known to occur in such material. With later broods sand was used, and with one exception no further trouble was experienced.

Preliminary note on the development of the larvae of Dirofilaria immitis in dog fleas Ctenocephalus felis and C. canis, A. BREINL (*Ann. Trop. Med. and Parasitol., 14 (1921), No. 3, pp. 389–392*).—The experiments carried out have proved that the larvae of *D. immitis*, a parasite commonly found in dogs at Townsville, Australia, can undergo a complete developmental cycle in the dog fleas *C. felis* and *C. canis*. A mature larva on one occasion was found to have penetrated the unbroken skin of a puppy, making its way into the subcutaneous tissue.

RURAL ENGINEERING.

The supply, the price, and the quality of fuel oils for pump irrigation, G. E. P. SMITH (*Arizona Sta. Bul. 92 (1920), pp. [4]+393–423, figs. 7*).—The progress results of studies of fuel oils for use in pump irrigation are reported.

The indications are that an adequate supply of gasoline and kerosene is assured for at least a year, but that long-time forecasts are impossible. Engine distillate, gas oil, and so-called twenty-seven-plus, the oils most used for pump irrigation, are being withdrawn from the market in California. The north Texas and Oklahoma fields are considered to be new sources of supply of much promise. Farmers and dealers are advised to make contracts during the winter for the year's oil supply.

The conclusion is drawn that the price of gasoline will fluctuate constantly with changes in the demand and production. Kerosene likewise will fluctuate in price, but should be cheapened somewhat by a reduction in the present freight rates. Gas oil is considered likely to remain at about the present price level. The price of Deisel engine fuel will always approximate that of boiler fuel oil and will be considerably less than prices of the lighter oils. Steam power plants using boiler fuel oil or coal can not furnish power at a cost low enough for pump irrigation districts.

With increasing demand, the tendency is to force the quality downward in gravity to the heaviest grades that the respective engines can burn. It is stated that fuel oils should therefore be purchased with specifications. In this connection the following specifications for California gas oils for pumping engines of the 4-cycle electric ignition type, based on tests reported, are given: The specific gravity shall be above 38° Baumé. The flash point shall not exceed 120° F. and the burning point 150°. The oil shall not contain a measurable quantity of acid either free or liberated during evaporation. When distilled in a standard 100 cc. Engler flask, by the U. S. Bureau of Mines method, the temperature, when 20 per cent is distilled, shall not exceed 375°, when 90 per cent is distilled 500°, and when 50 per cent is distilled 410°, and shall not exceed the average of the temperatures for the 20 and 90 per cent points. The oil shall not contain any water, sand, paraffin wax, free carbon, or any visible solid substance, and not over 0.2 per cent of sulphur. The general requirements for gas oil as compared with gasoline and Deisel engine fuel are shown by table.

Run-off from underdrained land and action of tile drains on ground water level (*Engin. and Contract., 55 (1921), No. 10, pp. 229–231, figs. 3*).—Experiments conducted by the U. S. Department of Agriculture in cooperation with the North Carolina Department of Agriculture, on the amount of run-off from underdrained land, the relation of run-off to rainfall, and the action of tile drains in lowering the ground water level, are reported, as described by *H. M. Lynde* at the third annual meeting of the southern section of the American Society of Agricultural Engineers, in a paper entitled "Drainage Investigations in North Carolina."

The experiments were conducted on two farms in northeastern North Carolina on areas of 52, 23, 12, 10, and 7 acres thoroughly drained by parallel laterals. The soils on one farm are nonhomogeneous and extremely variable in texture and include loams, sandy and clay loams, and sands. The soils of the other farm are homogeneous and consist of fine sandy loams.

The results are taken to indicate that for such soils texture is the controlling factor in the efficiency of underdrainage. "In nonhomogeneous soils the spacing and depth of drains should be such as to suit average soil conditions as near as they can be ascertained, consistent with economy. In general, in nonhomogeneous soils laterals should be arranged in parallel, straight lines at equal distances apart and at the same average depth. For North Carolina second bottom lands of this character, a minimum spacing of 60 ft. and maximum depth of 3 ft. are recommended. It is not believed that the additional benefits to be derived from spacing them closer or deeper than these figures will justify the cost. For Norfolk and Portsmouth fine sandy loam soils, with a surface slope exceeding 3 in. to the 100, a spacing of 125 ft. and an average depth of 3.5 ft. are recommended for laterals. On slopes flatter than this, a spacing of 100 ft. and a depth of 3 ft. are recommended on account of the possible existence of basins and no surface run-off. The economic rate of run-off to be adopted in the design of underdrainage systems on areas similar to those investigated appears to be 0.25 in. per 24 hours if the Chezy-Kutter formula with n=0.015 is used. . . . Possibly for Norfolk and Portsmouth fine sandy loams with extremely flat topography, it may be advisable to provide for a ⅜-in. run-off, if the laterals are spaced closer than 100 ft. The grades of the drains on the two experimental tracts are 0.2 per cent or greater and are self-cleaning. Observations on tracts with similar soils where the grades are less than 0.2 per cent appear to indicate that there is danger of silting in the smaller tile, unless the joints are protected, which may be done by wrapping with strips of building paper and covering with pine straw."

Land clearing, M. L. NICHOLS (*Alabama Col. Sta. Circ. 44 (1921), pp. 27, 28*).—Experiments on the removal of fat pine stumps by use of so-called Hercomite, a 60 per cent explosive; 20 and 40 per cent dynamites; and so-called DuBell dynamite indicated that the higher percentage explosives were the most economical, as more power was obtained for less money.

It was found that the cost of burning stumps was $15 per acre with no returns. When blasting, the value of the wood, exclusive of the hauling, more than equaled the cost of the labor and explosives.

A new method of blasting stumps was tested, in which the charge was placed deep in the heart of the tap root at least 2 ft. down. Under these conditions dynamite was able to cut the tap root off 18 in. deep and to split the stump.

Public Roads (*U. S. Dept. Agr., Public Roads, 3 (1921), Nos. 35, pp. 40, figs. 149; 36, pp. 32, figs. 17*).—These numbers of this periodical contain data as to Federal Aid Allowances—Project Statements Approved and Agreements Executed in January and February, 1921; and the following articles:

No. 35.—The Motor Truck Impact Tests of the Bureau of Public Roads, by E. B. Smith (see p. 82); Report on California Highways Ready; and Construction and Maintenance in Illinois.

No. 36.—Outstanding Features of Report of the California Highway Study; 9,231,941 Motor Cars and Trucks Registered by the States in 1920, by A. P. Anderson; Resurface Concrete Road with Reinforced Concrete, by T. M. Keene.

The motor truck impact tests of the Bureau of Public Roads, E. B. SMITH (*U. S. Dept. Agr., Public Roads, 3* (*1921*), *No. 35, pp. 3–36, figs. 148*).—This is a progress report of these impact tests (E. S. R., 42, p. 780.)

It is stated that the results presented must not be considered as final. The indications are, however, that the impact value depends very largely upon the tire equipment. The condition of the tire determines the amount of cushioning effect it may offer. Thin or worn solid rubber tires, even though they are very wide, produce very high impact forces. The deflection of the tire depends upon its depth and quality, and any condition of the tire which adds to its deflection will serve to reduce the impact.

The actual shape and construction of the tire seem to have considerable influence upon its cushioning effect. So far as they have been tested, cushion tires seem to offer a decided advantage in reducing the impact. In this connection it is stated that the name "cushion" on a tire does not necessarily make it such a tire, and that some definitions and deflection requirements should be adopted for the classification of tires.

Pneumatic tires show a very great influence in reducing impact values, and the impact produced with such equipment seems to increase only very slightly with the speed. The width of the tires or the load per inch of tire width has only very little controlling influence upon the impact. The deflection of the tire is the main factor, and this is controlled only slightly by its width. A decrease in tire width increases the load per square inch of tire, which in turn causes a slightly greater tire deflection. Thus, a large tire width does not tend to decrease the impact but rather to increase it, and a very wide but thin solid tire will give much higher impact forces than a narrow thick one.

Impact increases with the speed of the truck, but the relation is not a simple arithmetical ratio, nor can it be expressed simply as a certain power of the speed ratio. When striking an obstruction or irregularity, there is approximately a straight-line relation between impact and speed, but the equation of this curve depends upon the characteristics of the truck, the height of the obstruction, and the deflection of the tire as well as the speed. For approximate comparisons it is stated that the impact increases with the increase of speed from 10 to 100 per cent for solid tires, from 10 to 75 per cent for cushion tires, and from 0 to 10 per cent for pneumatic tires. An average of any of these limiting percentages must not be used. When dropping from one level to another the speed affects the impact value somewhat according to the percentage variations given, up to a critical speed of from 9 to 12 miles per hour. Beyond the point of critical speed at which the wheel falls freely there should be no increase in impact value.

Although heavy unsprung weights may give higher impact values than lighter unsprung weights, this is not the major controlling factor because such factors as tire equipment, spring stiffness, load carried, and speed, may have a greater influence and overcome any difference due to the unsprung weights. It is possible to so operate a light-weight truck under certain load and speed conditions that it will produce as high impact values as a heavy truck under certain conditions.

The impact values may be as high as seven times the load at one rear wheel for a solid tire when striking a 1-in. obstruction at 16 miles per hour, an average value being about four times. It is considered probable that for pneumatic tires the maximum impact value is not more than one and three-fourths times the load at one rear wheel and an average value is not more than 25 per cent.

The value of scientific investigations for the determination of the technical properties of wood, J. P. PFEIFFER (*De Waarde van Wetenschappelijk Onderzoek voor de Vastselling van Technische Eigenschapen van Hout. Amsterdam: J. H. de Bussy, 1917, pp. XII+290+[6], pls. 4, figs. 38*).—This book deals with microscopic, chemical, biological, and mechanical studies of wood as a structural material, with particular reference to tropical varieties. A review of the structural uses of tropical woods is followed by chapters on microscopic studies of woods in general and of tropical woods in particular. Other chapters deal with physical, chemical, and biological studies of these woods and with their mechanical properties, the purpose being to show the relations between these factors as affecting the structural use of the wood. Actual test data on six different types of tropical woods are included.

Alcohol production from molasses, G. M. APPELL (*Chem. Age [New York], 29 (1921), No. 2. pp. 53–57, fig. 1*).—General descriptions are given of the various processes which may be used for the manufacture of alcohol from black strap molasses. It is concluded that when the raw sugar industry receives $5 per ton for its black strap molasses it is sacrificing $15 worth of fertilizer ingredients, $14.50 worth of chemicals, and $20 worth of motor fuel at 30 cts. per gallon.

Scientific boiler feed water regulation: Can it be attained in practice? R. MOELLER (*Milk Dealer, 10 (1921), No. 6, pp. 10, 12, 14, 16, figs. 6*).—Methods and apparatus for the regulation of boiler feed water in dairies are discussed.

Investigation of the farm machinery business in Minnesota, J. H. HAY (*Minn. Dept. Agr. Bul. 10 (1920), pp. 27*).—This bulletin reports the results of an investigation of the practices prevailing in the manufacture and distribution of farm machinery in Minnesota and of the prices and profits involved in these activities.

It is concluded that the cost of labor and material used in the manufacture of farm implements for the years 1914, 1916, 1918, and 1920 equaled and in many cases exceeded factory prices of farm implements for the same years. The manufacturers within recent years have eliminated almost all the jobbers and wholesalers from the distributing part of the machinery business, apparently for the purpose of establishing a more direct route between factory and farmer and to reduce expensive distribution. This move did not translate itself, so far as was learned, into a reduction of price to the consumer. "It is reasonable to believe, therefore, that when it was not reflected in lower prices to the farmers, this gain was absorbed by the manufacturer."

It is further stated that exclusive contracts between manufacturers and local dealers are now considered obsolete, and that all retailers are practically on a cash basis.

Data on prison machinery manufacture and on the activities of implement associations in the regulation of retail prices are also included.

The report of the Departmental Committee on Agricultural Machinery, D. NEWTON (*Jour. Farmers' Club [London], 1921, pt. 1, pp. 18*).—The principal features of this report are presented and discussed.

Manual for the guidance of county councils and their architects in the equipment of small holdings (*London: Bd. of Agr. and Fisheries, 1919, 2 ed., rev. and enl., pp. 53, figs. 37*).—This manual, in two parts, is a short and condensed review of the more usual requirements of cottages and farm buildings on small holdings in England, with suggestions as to how they may be reasonably and economically met. Part 1 deals with the planning and construction of cottages, and includes plans and data on details of construction. Part 2 deals with the planning and construction of farm buildings and also includes both general and working drawings.

Dairy barns, O. R. Zeasman, G. C. Humphrey, and L. M. Schindler (*Wisconsin Sta. Bul. 325 (1921), pp. 34, figs. 25*).—Popular and semitechnical information on the planning and construction of dairy barns adapted to Wisconsin conditions is given in this bulletin, together with numerous diagrammatic illustrations describing the important features.

It is stated that as direct sunlight is a good disinfectant, it should be used to the utmost. Square projections of walls at the sides and bottom of the window cut off much direct sunlight. Windows should be as near the outside of the wall as practicable. A barn with its longer dimension north and south receives the most sunlight in the forenoon and late afternoon. An east and west position allows the absorption of the most sunlight during the middle of the day, when it is most effective.

A ventilation system is considered necessary, and the King system is said to be satisfactory for Wisconsin conditions. The rectangular barn with a gambrel roof is said to be the most popular in Wisconsin.

Live-stock sales pavilions, W. A. Foster and K. C. Ikeler (*Iowa Sta. Circ. 67 (1921), pp. 40, figs. 28*).—This bulletin deals with the general subject of live-stock sales pavilions and barns and contains many definite suggestions relating to their planning and construction. It includes also a number of diagrammatic illustrations and plan and detail drawings of recommended types. Considerable information regarding construction details and the organization of breeders' associations and pavilion companies is also given.

The four essential features of the sales pavilion are that it must have a sales ring, satisfactory seating, adequate barn room, and good light. The semicircular shape is said to best meet the requirements for a sales pavilion, and a building about 60 ft. across, permitting a ring 15 to 20 ft. in diameter and comfortably seating from 500 to 600 people, best meets the general requirements for the average sales pavilion.

Poultry house construction, R. H. Wilkins (*Winthrop Col., S. C. [Ext. Pamphlet], pp. [8], fig. 1*).—Plans for poultry houses adapted to South Carolina conditions are given and discussed.

An open front brooder house, G. R. Shoup (*Washington Sta., West. Wash. Sta. Mo. Bul., 8 (1921), No. 12, pp. 187–193, figs. 5*).—General information on the design of an open-front brooder house adapted for the hover over oil-burning brooder stoves is given, together with plans and section drawings.

Concrete houses: How they were built, edited by H. Whipple (*Detroit: Concrete-Cement Age Pub. Co., 1920, pp. 215, pls. 16, figs. 445*).—This book is a compilation of a number of articles descriptive of various types of concrete houses and the details of their construction.

RURAL ECONOMICS AND SOCIOLOGY.

Research and the farmer, E. T. Meredith (*Banker-Farmer, 8 (1921), No. 4, pp. 10, 11, fig. 1*).—A sketch of some of the economic results of research by scientists of the U. S. Department of Agriculture into crop and live-stock diseases and pests as applied to agricultural production, as well as some projected lines of investigation, especially into problems of financing production and the marketing of products, is given here.

Washington's home, Mt. Vernon, as a farm, C. J. Galpin (*World Agr., 1 (1921), No. 4, pp. 65–68, figs. 6*).—This is an abstract of an address given before the Country Planning Conference of the American Civic Association, at Amherst, Mass., in October, 1920, describing the arrangement of the manor house and farm buildings for seclusion and yet convenience to the farming operations. It is illustrated with photographs and a reproduction of a lithograph, dated 1852, furnished for the article by the Library of Congress.

Agriculture in the United States, [E. T. MEREDITH] (*World Agr., 1 (1921), No. 4, pp. 70, 71, fig. 1*).—Information from recent official speeches and reports regarding the work of the U. S. Department of Agriculture relative to the farming industry of the United States is given here.

The agricultural situation, H. C. WALLACE (*U. S. Dept. Agr., Weekly News Letter, 8 (1921), No. 33, pp. 1, 6–8; also in Com. West, 39 (1921), No. 12, pp. 32, 33, 48, 49; Com. and Financial Chron., 112 (1921), No. 2908, pp. 1097–1099*).—This statement is made reviewing the general agricultural situation of the country and noting the disturbing effect of agricultural prices on the farmers' output.

Mobility of the factors of production as affecting variation in their proportional relation to each other in farm organization, J. G. THOMPSON (*Jour. Polit. Econ., 29 (1921), No. 2, pp. 108–137*).—Reorganization of individual farms in large estates, sale and purchase, settlement of estates, renting of additional land by owners, and the changing to more or less intensive types of farming are regarded as phases of mobility of land. Changes with regard to the labor factor are said to be secured by hiring and discharging laborers, variations in the length of working hours and intensity of exertion on the part of farm workers, mutual exchange of laborers among neighboring farmers, the shifting of labor between different branches of farming, physical removal of farm labor from one section of the country to another, and migration of farm laborers. Of all the factors of production in agriculture, capital is regarded as the most varied in the degree of mobility that attaches to it. Methods of shifting include physical transfer from place to place, changed use, withdrawal or replacement of wornout capital, purchase or sale, hiring or leasing, and cooperative ownership and use. The management factor may be increased or diminished by education, by the association of different individuals and of a varying number of individuals in the management of an area, by varying the intensity of the management, by transfer of business ability between agriculture and other lines of business, and by combining other occupations with agriculture.

The choice of crop enterprises based on returns for labor, A. BOSS (*Jour. Farm Econ., 3 (1921), No. 1, pp. 30–40*).—This paper sets forth data relative to the return for labor expended on certain Minnesota crops, spring wheat and corn, particularly, as well as notes on the labor expense of potatoes, tobacco, and flax.

Cost of production; its relation to price, A. B. COX (*Texas Sta. Circ. 26 (1920), pp. 3–11*).—This discussion is intended to state principles operating in price determination and to discuss cost of production as an important factor modifying supply, using the term cost of production in the sense of the expense or money cost. As a consideration in price fixing it is held to be only equally important with the demand, both being subject to wide fluctuations. Farmers and ranchmen are urged to study the commercial side of their business, especially the anticipated price and probable cost of production. The policy of diversification and cutting down cost is recommended in coping with the present situation.

What the retailer does with the consumer's dollar, T. MACKLIN and P. E. MCNALL (*Wisconsin Sta. Bul. 324 (1921), pp. 3–22, figs. 2*).—The results of an investigation of retail marketing of food products in the city of Madison, conducted by the station cooperating with the Wisconsin Division of Markets, are presented.

It was found that retailers of food received margins of from 15 to 16 per cent during 1919. Operating expenses took from 11.7 to 12.3 cts. on an average of each dollar's worth of goods sold, while balances averaged 2.5 to 4.5 cts. It is said that Madison food retailers did not profiteer in 1919, that they were strictly competitive, and that they did not receive exorbitant salaries or profits. The inefficiency of the present food retail system is attributed to the fact that the majority of stores are too small to be efficient either in operation or as competitors of large stores.

Farm management in the Ozark region of Missouri, H. M. Dixon and J. M. Purdom (*U. S. Dept. Agr. Bul. 941 (1921), pp. 51, figs. 16*).—This bulletin is based on the study of the organization and management of 79 farms distributed in five counties in the southern and southeastern Ozark region of Missouri. Thirty-one of these farms are representative of the conditions of rolling and hilly upland farms; the other 48 are situated in the valley and level uplands.

The data presented are for the year 1917. The season was good and prices of every article sold from the farms were higher than in previous years and more than compensated for increased expenses, so that conditions were favorable to a good labor income for the operators.

Topographical and climatic conditions together with transportation facilities in this region are described.

In summarizing the business of the rolling and hilly upland farms, they were placed in two groups, those with 40 acres or under in crops and those with over 40 acres in crops. The average size of the farms in the smaller-size group was 128 acres with 26 acres in crops and $3,832 capital, while the larger-size group averaged 240 acres per farm with 72 acres of crops and $7,133 capital. The valley and level-upland farms were classified in three groups, those with 40 acres or under, those with 40 to 70 acres, and those with over 70 acres in crops. The farms with 40 acres or under in crops averaged 29 acres in crops and had an investment of $4,631 per farm; those in the second group averaged 52 acres in crops and an investment of $8,937; while the farms in the third averaged 105 acres in crops with an average investment of $12,602.

The operators of rolling and hilly farms had in 1917 an average labor income of $309, and those operating farms of the second type, an average of $646. Of the 79 farms studied, 20 per cent had no labor income after making the usual deductions, and 21 per cent had a labor income above $1,000. The family income on the rolling and hilly farms averaged $759 and on the valley level-upland farms $1.331. It is indicated by this investigation that farms of the general live-stock type with less than 40 acres of crop land are generally unsuccessful.

Live-stock farming is the principal agricultural industry of this region, and the production and sale of cream is growing in importance. The average annual production per cow of 78 cows on 7 dairy farms was 142 lbs. of butter fat. The introduction of animals of greater productive capacity is recommended.

Losses of live stock on the farms for the year studied were as follows: Cattle 3.6 per cent, horses and mules 3.4, sheep 8.9, hogs 10.7, and goats 11 per cent.

It is suggested that pastures be improved, that auxiliary drought-resistant hay crops be grown, and that silage be provided for winter feed and for supplementing summer pasture.

Alfalfa, clover, soy beans, and cowpeas are grown in this region. Their importance both for hay and grazing is emphasized.

The labor income of each of the farms studied is graphically illustrated for the sake of comparison and detailed analyses are given of the business of 10 individual farms showing wide differences in organization and efficiency.

The horse and the tractor: An economic study of their use on farms in central Illinois, W. F. Handschin, J. B. Andrews, and E. Rauchenstein (*Illinois Sta. Bul. 231 (1921), pp. 171–224, figs. 22*).—Data on the cost and use of horse labor and of tractors, based on cost-accounting and general-management studies carried on in central Illinois during the years 1913 to 1918, inclusive, are reported.

In the aggregate, detailed accounts are reported from 112 farms; that is, an average of 22.4 farms for each of the five years, 1913 to 1917. The records on the use of farm tractors were obtained mainly during the fall of 1918 by means of personal interviews with 100 farmers, each of whom had used his tractor one or more years. With but few exceptions, the horses used on the farms in the area studied ranged in age from 3 to 15 years and varied in weight from 1,300 to 1,500 lbs. They were kept primarily for draft purposes.

It was found that horse labor makes up from 30 to 40 per cent of all farm operating expenses in the corn belt, and is considered the one item above all others which can be profitably reduced by good methods of farm organization and operation. The total cost of horse labor on the farms under investigation in Hancock County during the years 1913–1918 was found to be made up in the following proportions: Feed 72 per cent, labor 11.28, interest 8.03, shelter 3.1, harness 3.44, and miscellaneous expenses 2.2 per cent. The average annual cost of keeping horses during the years 1913 to 1916, inclusive, on the farms studied ranged from $87.09 to $96.02 per horse. In 1917 it increased to $130.94 and in 1918 to $156.58.

It was found that reducing the cost of horse labor is effected by reducing the total carrying cost and by securing the largest possible amount of productive work per horse. Reduction in the total cost of carrying horses is effected mainly by (1) economical feeding, care, and management, (2) raising good colts, and (3) reducing depreciation charges. The largest amount of productive work per horse is secured mainly through (1) a farm sufficiently large, (2) crop rotations providing an even distribution of horse labor throughout the year, (3) production of two or more classes of live stock, (4) convenient lay-out of fields, and (5) classifying and scheduling of all farm work for the even distribution of horse labor throughout the year. Extreme variations in the distribution of horse labor throughout the year were found on representative farms, due largely to the difference in crop rotations practiced.

Approximately 25 per cent of the total labor performed on farms is classified as tractor labor, and the remaining 75 per cent as either nontractor or doubtful tractor labor. When only horses are used on a farm, the number required is determined by the peak load of labor, which, in the corn belt, occurs normally in the month of May in connection with soil preparation, corn planting, and cultivation. When a tractor is added to the equipment the number of horses required is determined by the peak load of nontractor labor, which occurs in June and July in connection with corn plowing, haymaking, and harvesting. It is estimated that farms using horses only, could, in general, displace 22.1 per cent of their horses if a tractor were added to the equipment, and under the most favorable conditions could displace 34.4 per cent. For the 100 farms studied in the tractor survey, the average horse displacement when the tractor was added was 20.6 per cent. The horse displacement effected by the 24 farms which made the best use of their horses and tractors combined was 33.1 per cent.

The principal advantage in the use of the farm tractor is considered to come through the actual displacement of horses. Of the 100 farms studied in the tractor survey, none reported increase in crop yield as an advantage secured by the use of the tractor. Relatively little saving in man labor was effected by the use of a tractor. It is concluded that on the average corn-belt farms, growing less than 240 acres of crop, horse costs can not be reduced enough to offset the cost of operating a tractor.

Farm tenancy in Illinois (*Banker-Farmer, 8 (1921), No. 3, pp. 2, 3, fig. 1*).—This is the report of the Illinois Commission on Farm Tenancy, which held public hearings in February, 1920, in grain farming and live stock farming sections and sections where dairy farming and tenancy prevail. Its recommendations include (1) a transfer tax of 1 per cent of the selling price on all transfers made in less than one year after ownership is acquired in order to discourage speculation in land; (2) the reimbursement of the tenant on the termination of his lease for improvements put on the land, as well as protection for the landlord against unnecessary destruction of property by a careless tenant; (3) the enactment of necessary legislation to protect and promote second mortgage loans on farm land; and (4) an appropriation for the purpose of making a farm tenancy survey through the farm management department of the University of Illinois.

Discussion relating to inward and outward movement of agriculturists, A. L. BARKMAN (*Jour. Farm Econ., 3 (1921), No. 1, pp. 16–19*).—Tables showing respectively the inward and outward movement of alien agriculturists during the years 1913 to 1920, inclusive, total alien immigration and emigration during the period, the number of agriculturists who left the United States for Canada in 1920 stating that they did not intend to return within one year, the race of naturalized citizen agriculturists who left the United States during the year ended June 30, 1920, and the race of native-born agriculturists who departed during the same period, are given here with brief interpretive text. The material furnished the basis for the discussion previously noted (E. S. R., 44, p. 196).

A plan for reclaiming and peopling the mesa lands bordering the Imperial irrigation district, E. MEAD (*California Sta. [Pamphlet], 1919, pp. 6*).—In these pages is published a letter setting forth the need for government financial support of irrigation works in this district. Objections are raised to certain proposed plans of sale of lands for subsequent development after irrigation works are completed, and a plan for setting aside certain territory as a State land settlement project is outlined.

The farm labor problem, D. D. LESCOHIER (*Jour. Farm Econ., 3 (1921), No. 1, pp. 10–15*).—This is a portion of the address previously noted (E. S. R., 44, p. 196).

Farm labor experience of the employment service of Canada, B. M. STEWART (*Jour. Farm Econ., 3 (1921), No. 1, pp. 20–23*).—The address previously noted (E. S. R., 44, p. 196) is published in these pages.

[Annual report of the Jewish Agricultural and Industrial Aid Society for the year 1920] (*Jewish Agr. and Indus. Aid Soc. Ann. Rpt., 1920, pp. 58*).—This report continues information previously noted (E. S. R., 43, p. 192).

Farming conditions in Guam, W. J. GREEN (*Guam Sta. Rpt. 1919, pp. 45–47*).—Brief descriptive notes, relating to crops and live stock produced and agricultural methods followed in this region, are given.

Cooperative grain marketing, a comparative study of methods in the United States and in Canada, J. M. MEHL (*U. S. Dept. Agr. Bul. 937 (1921), pp. 21, figs. 5*).—A history of the grain growers' organization movement in Canada and in the United States, with the establishment, in the first instance, of centrally controlled elevators of the so-called line-house type as distinguished from the single-unit type characteristic of farmers' elevators in the United States, wherein ownership and control is vested in a body of stockholders in the immediate surrounding community and which are operated as separate units independently of any other similar elevators, is outlined. The differences in the farmers' elevator movements in the two sections are attributed to the facts that in the beginning capital was not readily available at local points in

Canada and that farms were large and storage accommodations inadequate. Examples of organizations in the two regions are described.

It is said that the Canadian system of line-house operation would seem to offer greatest advantage in those States where crops are somewhat uncertain or where the crop year is short, under which conditions it may be difficult to secure the type of management necessary. Further, it is pointed out that Winnipeg, Can., is the gateway through which a large proportion of western Canadian grain is marketed each year and that terminal marketing activities tend to center there, while in the United States several large terminal markets exist.

The line-house method is said also to allow standardized construction and machinery, to make possible the closing of elevators in affected areas during periods of crop failure due to hail or drought or during dull periods, and to admit of centralized accounting systems. The local single-unit farm of cooperative elevators may be said to foster community pride and to function where a prejudice exists against centralized authority.

A digest of the Canada Grain Act, C. BIRKETT (*Farmer's Advocate and Home Jour., 55 (1920), Nos. 1463, pp. 1613, 1617; 1464, pp. 1658, 1659, 1674*).—A complete and concise analysis of the Canada Grain Act of 1912 with subsequent amendments, dealing with marketing of grain at country points, grain inspection, weighing of grain, terminal elevators, Eastern public elevators, and the Board of Grain Commissioners. Facsimiles of the various forms provided for in the act are included.

Uncle Sam's live stock grades, S. BRAY (*Banker-Farmer, 8 (1921), No. 4, pp. 5, 6, fig. 1*).—The author describes the value of the producers' live stock reporting service of the Bureau of Markets, U. S. Department of Agriculture.

Monthly Crop Reporter (*U. S. Dept. Agr., Mo. Crop Rptr., 7 (1921), No. 3, pp. 25–36, figs. 4*).—The usual monthly estimates of acreage and condition of crops, stocks and farm value of important products, average of prices received by producers in the United States, and range of prices of agricultural products at important markets are given, together with United States and foreign crop summaries. The percentage of the season's total farm movement of wheat marketed between July 1 and the first of each subsequent month through a period of years, also the estimated quantity of wheat marketed, are charted. Prices of things farmers sell and buy are tabulated and charted, showing that one acre of crops had in 1920 only 67 per cent of the purchasing power of that in 1914. The merchantable corn crop of a series of years, trends in agricultural statistical data, value of plow lands, green bug and Hessian fly damage to wheat, and the quantity and value of cordwood consumed on farms in 1920 are subjects of special tabulations.

The Market Reporter (*U. S. Dept. Agr., Market Rptr., 3 (1921), Nos. 11, pp. 161–176, figs. 4; 12, pp. 177–192; 13, pp. 193–208; 14, pp. 209–224*).—Abstracts of information on domestic movement, imports and exports, prices, and the situation in the market of specified commodities and important classes of agricultural products, together with analyses of foreign market conditions, are given in these numbers covering the month up to about March 25. Light receipts and dullness seem to have been general in the markets during this period. Slight rises and declines are noted with reference to live stock and meats, other commodities declining or remaining fairly steady.

The world's cheese trade since 1913 is briefly outlined in No. 11. In No. 12, the city of Philadelphia is described in a special article as the third most important market of the United States for fruit and vegetables. In No. 13, the trade in kosher meats in New York City is described, and statistics are given showing the French importations of wheat with comparisons for the prewar period.

Statistical information relating to stocks, cotton, grain, provisions, live stock, seeds, crops, imports, exports, etc. of principal countries, 1920 (*Howard, Bartels & Co., Inc., Chicago, Statis. Inform. Stocks, Cotton* [*etc.*], *1920, pp. 54*).—In addition to statistics of prices on the Chicago market, this publication gives brief reviews of how trading is conducted on the Chicago Board of Trade and reproduces official grain standards for wheat. Summaries of data for previous years and for a number of foreign countries are included.

Annual statistical report of the New York Produce Exchange for the year 1919 (*N. Y. Prod. Exch. Ann. Statis. Rpt., 1919, pp. 137*).—This continues information previously noted (E. S. R., 41, p. 294).

[Agricultural Statistics of Denmark] (*Statis. Aarbog Danmark, 25 (1920), 40–66*).—The annual statistics of land in cultivation and yields, numbers of live stock, and output of dairy products are given in these pages, continuing information previously noted (E. S. R., 43, p. 295).

[Agricultural statistics of Saxony] (*Statis. Jahrb. Königr. Sachsen, 43 (1916–17), pp. 99–114*).—Statistics given here covering acreage and yields of important crops and numbers of live stock resume reports previously noted (E. S. R., 35, p. 297).

AGRICULTURAL EDUCATION.

[Agronomy teaching in the State agricultural colleges] (*Jour. Amer. Soc. Agron., 13 (1921), No. 2, pp. 49–81*).—The following papers were presented at the thirteenth annual meeting of the American Society of Agronomy, held at Springfield, Mass., October 18, 1920:

Prerequisites for agronomy subjects, L. E. Call (pp. 49–53).—From a comparison of the curricula as shown by the most recent catalogues of 25 of the leading agricultural colleges and universities in this country, three classes were found as regards the requirement of prerequisites for agronomy: (1) Those that require no prerequisite and offer farm crops in the freshman year, (2) those that require general botany as a prerequisite and offer the work in the sophomore or junior year, and (3) those that require general botany and soils as prerequisites and offer the work in the junior year. These plans are briefly discussed. The author is of the opinion that for the best interests of all students the course in farm crops should be given in the sophomore year, and that general botany, with an agricultural trend, and chemistry should be required as prerequisites.

The standardization of courses in field crops, J. B. Wentz (pp. 53–59).—The author discusses the uniformity of work offered by similar institutions, the division of subject matter between the departments of a single institution, and the division of subject matter into courses within a department to prevent duplication of material. As regards the first of these phases, he presents a brief survey of course material in field crops now being offered. He finds 133 differently named courses in field crops which, if classified according to subject matter or content, are reduced to 47. Of these only 20 are offered by more than one or two colleges.

The first college course in field crops, W. L. Slate, jr. (pp. 59–63).—On the premise that there is a real science of field crops or a body of information that belongs to the subject, the author discusses the following problems of a first course called field crop production: Type, aims, and content of the course, together with the method of teaching, relation of the sciences and other courses, relation to the specialized courses in crops and to farm experience and high-school agriculture, place in the curriculum, and the amount of credit allowed.

The teaching of soils in agricultural colleges, W. H. Stevenson and P. E. Brown (pp. 63–70).—The status of the teaching of soils in a large number of agricultural colleges, it is stated, seems to warrant the conclusion that more satisfactory results may be secured by uniting all phases of soil instruction in one organization or department. Failure to organize the work on this unit basis is due almost entirely, it is believed, to the attitude of teachers of pure science and of administrative officers. Basing the teaching of soils too largely upon the local experiments also sometimes interferes with the normal development of soils courses. Four important problems of soils teachers are briefly considered, viz, the number and sequence of courses and the amount of work in each, the subject matter presented in each course, the character and amount of laboratory work, and the general method of presenting soils instruction to students. It is concluded that no college can teach soils properly in two or even three quarter or semester courses, and that not less than four or five courses, of one quarter or term each, should be required in a four-year agricultural course for students majoring in farm crops, soils, animal husbandry, farm management, or horticulture. Some facts regarding the soils work at the Iowa State College of Agriculture and Mechanic Arts are given.

The teaching of soils, M. F. Miller (pp. 71–78).—This is a discussion of some of the findings of the conference of soils instructors at the University of Kentucky, June 23–25, 1920 (E. S. R., 44, p. 697).

The introductory course in soils, A. B. Beaumont (pp. 79–81).—The author calls attention to at least two schools of thought on the nature of laboratory work in soils for the so-called average four-year student who has only an average interest in soils, viz, those who would limit the laboratory work to operations which the student will be using, or at least which will be of direct value, in postgraduation activities, and those who would have the laboratory work include, in addition to the utilitarian exercises, those which may enlarge the student's vision and stimulate his interest. The possible value of the laboratory study of soils in an introductory course in acquainting the student with materials, teaching soil science, teaching the principles involved in soil investigations and in soil management, ascertaining definite information concerning specific soils, formal discipline, and in arousing and stimulating interest in soil science, are briefly discussed.

How to teach agriculture: A book of methods in this subject, A. V. Storm and K. C. Davis (*Philadelphia and London: J. B. Lippincott Co., 1921, pp. VII+434, pl. 1, figs. 222*).—This comprehensive text on methods is intended for teachers in service who are teaching agriculture in the one-room country schools, consolidated schools, high and normal schools, etc., for teacher-training students in colleges, and normal and high schools, for superintendents, principals, and supervisors, and others who are responsible for the supervision of the teaching of agriculture. It offers instruction on how to organize for and manage the teaching of agriculture; methods in the teaching of agriculture; how to teach agronomy, animal husbandry, dairying, poultry husbandry, horticulture, farm mechanics, engineering and shop work, farm management, the management of soils and fertilizers, in the classroom, laboratory, and field; how to conduct home projects and a land laboratory; how to equip for teaching agriculture; how to teach through charts, slides, and films, and organize an agricultural library; and how to conduct community work. Each chapter is followed by suggested exercises, and lists of agricultural textbooks for high schools, books and bulletins, aids in teaching agriculture, the agricultural experiment stations, American live stock record associations, etc., are appended.

Training teachers of secondary agriculture, C. R. Mann (*U. S. Bur. Ed., School Life, 6 (1921), No. 3, p. 5*).—In considering the minimum requirements for thorough professional training of teachers of secondary agriculture, the author discusses briefly (1) the need of instruction in rural economics, farm management, and rural social problems, (2) the relative expensiveness of broad professional training, which he believes is warranted by the importance of the work, because of the proportional staff to number of students taking the work and the many professional courses required, (3) proper provision for practice teaching, (4) the effects on the character of the teaching in the technical departments of colleges, and (6) the necessity for mutual obligation in regard to this work among the States.

The scientific study of agriculture, P. Hillmann (*Fühling's Landw. Ztg.*, *69 (1920), No. 7–8, pp. 121–130*).—The author outlines and discusses a suggested systematic reorganization of the agricultural course in the agricultural high schools and university institutes in Germany to comprise four semesters, each including 24 hours per week of theoretical instruction, for the training of practical farmers, and two additional semesters for the training of State agricultural officials, agricultural instructors, etc. He would devote the first two semesters to the study of eight fundamental subjects, viz, chemistry; physics; zoology; animal anatomy and physiology; botany, mineralogy, petrography and geology; political economy; and mathematics, drawing, construction, leveling, and surveying. The third and fourth semesters would include instruction in general agriculture, including plant production and agricultural engineering; special plant and seed production; general and special animal husbandry, including feeding and dairying; rural economics, including farm management, the history of agriculture, taxation, and bookkeeping; agricultural machinery; animal diseases; technology (fermentation and sugar industries); law and agricultural geography; horticulture; poultry; human hygiene; and forestry.

From 2 to 3 hours on five afternoons a week should be reserved for practical exercises and the evening hours (after 5 o'clock) for special lectures and general sciences. No lectures in agriculture and the natural sciences should be given in the fifth and sixth semesters during the day until 4 o'clock. This time should be reserved for work in the laboratories and in the institutes for political economy, farm management, training in the experiment field, etc., to attend special lectures at the university, the technical high school, and the oriental seminar (for colonial work).

The plan provides for a first examination at the close of the second semester, a diploma examination at the close of the fourth semester, and the doctor's examination on the completion of the six semesters. The author believes this plan will offer students a broader perspective than the present endless lecture system with few practical exercises, and that many more students will be attracted to the training for scientific work.

The new forest high school, K. Kempf (*Allg. Forst u. Jagd. Ztg., 88 (1920), No. 24, pp. 153, 154; 26, p. 167; 27, pp. 172, 173*).—The author briefly outlines the instruction for a proposed specialized forestry high school, including instruction in the lumber industry and trade, and preceded by two or three year preparatory forestry schools in connection with intermediate schools, or a two-year preparatory course in the high school.

The organization of the forestry personnel and its training in Greece, C. G. Sklawunos (*Forstwiss. Centbl., n. ser., 42 (1920), No. 12, pp. 443–450*).—An account is given of the development and present organization of the forest service of Greece, included since 1917 in the department of agriculture, and of the training of the forestry personnel.

Corn book for young folk, C. B. Williams and D. H. Hill (*Boston: Ginn & Co., 1920, pp. V+250, figs. 186*).—This text deals with corn growing and harvesting, corn silage, and storing the ears. Suggestions for the practical application of the lessons are included.

Farm horticulture, G. W. HOOD (*Philadelphia: Lea & Febiger, 1921, 2. ed., rev., pp. VII+17-354, figs. 144*).—This is a second edition of this work, previously noted (E. S. R., 41, p. 96), with minor revisions and some rearrangement of the subject matter to conform more closely to the usual methods of horticulture.

A year's work in vocational agriculture: Horticulture, N. E. FITZGERALD (*Tenn. Dept. Pub. Instr. Bul. 3 (1919), pp. 34*).—This course comprises outlines of lessons on fruit growing, plant pests—insects and diseases, landscape gardening, farm forestry, and vegetable gardening. Suggestions with reference to the division of time, home projects, and library and laboratory equipment are included.

A year's work in vocational agriculture: Animal production (*La. Dept. Ed. Bul. 13 (1920), pp. 88*).—This course in animal husbandry for the even years of the eighth and ninth grades of Louisiana schools consists of (1) lessons on cattle, horses, swine, sheep, diseases and defects of animals, dairying, and poultry husbandry, (2) study outlines for pig, baby beef, dairy herd, egg production, and poultry raising projects, and (3) 106 laboratory exercises, of which at least 50 must be completed and recorded in individual notebooks in order to obtain credit. Lists of references to helpful literature and required laboratory equipment are included.

A unit course in poultry husbandry, C. H. SCHOPMEYER (*Fed. Bd. Vocat. Ed. Bul. 63 (1921), pp. 34*).—This outline of a unit course in poultry husbandry, intended for agricultural teachers and teacher trainers, suggests a year's work centered around the management jobs and jobs of operation involved in handling a small flock of poultry as a side line to general farming, or in poultry raising as the most important enterprise on the farm. Related subjects, classified for correlation, exercises, materials and supplies, and sources of information are included throughout the outline. The course is expected to be of special value in part time and evening class work in agriculture. Suggestive poultry survey forms and a system of accounting for the poultry enterprise are appended.

School and home cooking, C. C. GREER (*Boston: Allyn & Bacon, 1920, pp. XXI+530+3-24, pl. 1, figs. 95*).—This text consists of a study of body regulating, body building, energy giving, and health and growth promoting foods, flavoring materials, food combinations, food preservation, etc., together with related work comprising table service lessons, a consideration of the cost and food value of meals, food selection and buying, food requirements, infant feeding, diet for young children, food for the sick, home projects, and experiments in food preparation and composition and the processes of digestion.

Evening courses in home economics for Idaho schools, G. B. ELWELL and K. S. NORTH (*Idaho Bd. Vocat. Ed. Bul., 3 (1920), No. 4, pp. 19*).—Evening courses are outlined in the household budget; household management and housewifery, house planning, household furnishing and decoration, home health and nursing, garment construction, advanced dressmaking, tailoring, millinery, renovation, remodeling, laundering, food preparation, mother craft and child welfare, etc.

Type course of study for vocational home economics departments in negro schools, C. C. HELBING (*Baton Rouge, La.: Dept. Ed., 1920, pp. 16*).—The course outlined extends through two years and includes plain sewing, care of the home, cooking, and laundering in the first year, and dressmaking, millinery, crafts (such as rug and mattress making and basket weaving), advanced cooking, infant care and feeding, and invalid cookery in the second year. Five 90-minute periods a week for one term are given to each of the subjects.

Trade and industrial education for girls and women, A. L. BURDICK (*Fed. Bd. Vocat. Ed. Bul. 58 (1920), pp. 106, figs. 6*).—This bulletin treats of the economic and social aspects of vocational education for girls and women, and of ways and means of establishing and operating a program, including types of vocational schools and training agencies. A detailed synopsis of the contents of this bulletin and a classified bibliography on women in industry are appended.

Standards for judging agricultural club efficiency, W. W. CHARTERS and J. H. GREENE (*School Sci. and Math., 21 (1921), No. 2, pp. 116–121*).—In this study, based on the replies to a questionnaire received from 55 State club leaders, the authors find a startling lack of uniformity about the importance of items used in judging club efficiency. No unanimity was noted regarding the ends to be obtained by State leaders either in the individual States or in the Nation, although there was somewhat more agreement among leaders in the same State than among the different States. The authors conclude that the completion of the project and the making of a report are considered to be of most importance in general, while cooperative buying and club friendships are regarded as of the least importance.

Boys' and girls' club work, W. J. GREEN (*Guam Sta. Rpt. 1919, pp. 49, 50*).—The objects and rules governing the corn, copra, bean, taro, pig, and poultry clubs, which on July 1, 1919, had a total enrollment of 499, are briefly set forth.

MISCELLANEOUS.

Annual report of the director of the experiment station on work done under the Local Experiment Law in 1920, J. F. DUGGAR (*Alabama Col. Sta. Circ. 44 (1921), pp. 28*).—This includes a summarized report by the director of work in all departments conducted under this State law for 1920, a financial statement for the year, and detailed reports of heads of departments. The experimental work reported is for the most part abstracted elsewhere in this issue.

Thirty-third Annual Report of Georgia Station, 1920 (*Georgia Sta. Rpt., 1920, pp. 12*).—This contains the organization list, reports by the president of the board of directors and the director of the station on its work during the year, and a financial statement for the fiscal year ended June 30, 1920. The experimental work reported is for the most part abstracted elsewhere in this issue.

Report of the Guam Station, 1919 (*Guam Sta. Rpt. 1919, pp. 52, pls. 7*).—This contains reports of the animal husbandman in charge and the agronomist and horticulturist, and the extension agent, and meteorological observations. The experimental work recorded is for the most part abstracted elsewhere in this issue.

Thirty-third Annual Report of Illinois Station, 1920 (*Illinois Sta. Rpt. 1920, pp. 23, fig. 1*).—This contains the organization list, a financial statement for the fiscal year ended June 30, 1920, brief notes as to the principal lines of work, and a list of publications of the year. Brief notes of progress in horticultural studies are abstracted on page 44 of this issue.

Monthly bulletin of the Western Washington Substation (*Washington Sta., West. Wash. Sta. Mo. Bul., 8 (1921), No. 12, pp. 181–196, figs. 6*).—In addition to articles abstracted elsewhere in this issue, this number contains a brief article entitled Concerning Feedstuffs, by H. E. McNatt.

A classified list of projects carried on by the agricultural experiment stations, 1919 (*U. S. Dept. Agr., States Relat. Serv. [Pamphlet], 1919, pp. XIV+225*).—This multigraphed list has been noted editorially (E. S. R., 44, p. 1).

NOTES.

Alabama College and Station.—J. F. Duggar, director since 1903, retired from this position July 1 to become consulting agriculturist, a position in which more time will be available for study and writing on agronomy. D. T. Gray, chief in animal industry in the North Carolina College and Station, has been appointed director, beginning September 1.

The department of plant pathology, heretofore an independent department, has been made a division of the college and station department of botany.

California University and Station.—The appropriations of the State legislature for the ensuing biennium for instruction, experimental, and extension work in agriculture aggregated $2,500,000, an increase of 94 per cent over the previous biennium. In addition $400,500 was granted for buildings at the university farm at Davis, and $127,587.50 to complete the purchase of land and water rights for the proposed farm school at Riverside, as compared with an allotment of $30,000 in the previous biennium for a first payment for land and water rights at Riverside.

Dean Thomas Forsyth Hunt returned June 25 from a year's stay in Europe, spent in part at Rome as the delegate of the United States to the International Institute of Agriculture. Sabbatical leave for travel and study has been granted to W. T. Clarke, professor of agricultural extension; Thomas Francis Hunt, associate professor of agricultural extension; and R. S. Vaile, assistant professor of orchard management in the Citrus Substation.

Connecticut State Station.—The legislature has increased the biennial appropriation from $45,000 to $82,000. It has also appropriated $10,000 for investigations on matters connected with the production of tobacco. The station has secured an excellent field of about 13 acres where experimental work may be carried on along this line.

Delaware University and Station.—T. T. Martin, State leader of girls' and boys' club work, has resigned to accept a position with the Junior Achievement League with headquarters at Springfield, Mass. J. H. Clark (Purdue University, 1921) has been appointed instructor in horticulture and assistant horticulturist to succeed B. Davison, beginning July 1, and A. E. Tomhave (Pennsylvania State College, 1921) instructor in animal husbandry. In the division of rehabilitation in the school of agriculture, C. E. Phillips (Delaware University, 1921) has been appointed instructor in agronomy and Ray Koon instructor in horticulture.

Iowa College and Station.—According to a note in *Iowa Agriculturist*, H. D. Hughes, head of the farm crops department, has been granted a year's leave of absence to be spent with the Alabama Annual White Sweet Clover Growers' Association.

Kansas College and Station.—The State board of agriculture has accepted an invitation to hold one of its regular quarterly meetings each year at the station. About 20 State-wide agricultural organizations now hold one or more such meetings each year.

The first "Ag Fair" was held at the college May 3 by students of the division of agriculture. The fair contained educational exhibits from each of the departments of the division and a large number of amusement and carnival features by the students. The receipts from the various small admission fees paid by the 6,000 people who visited the fair exceeded $2,000, a sum sufficient to pay all expenses of the fair and to provide a good surplus for future use by the Agricultural Students' Association.

The animal husbandry department is conducting a 3-year experiment, the chief object of which is to determine the respective value of alfalfa hay and silage as the sole roughage in a winter maintenance ration for steers which are kept on native pasture during the spring, summer, and autumn months. The experiment began in December, 1919, with 40 head of high-grade Hereford steer calves. The same animals are to be used throughout the 3-year period. They are pastured together during the pasture season each year and are divided into two groups for feeding each winter. During the winter, 20 of the animals (group A) receive alfalfa hay only, and the 20 others (group B) receive silage and cottonseed cake only. Each winter group A is divided into four lots which are used to test the feeding value of alfalfa hay cut at four different stages of growth, and group B is divided into two or more lots each winter and used to test the value of silage made from cane and corn, respectively, or of corn silage made by various methods. Individual weights are to be secured every 30 days throughout the 3-year period.

C. A. Herrick has been appointed research assistant in zoology in connection with parasitological investigations. J. H. Moyer has been appointed assistant in agricultural economics.

Massachusetts Station.—Dr. George H. Chapman, research physiologist, has resigned to accept a position with the Connecticut Valley Leaf Tobacco Improvement Association, with headquarters in Connecticut.

Minnesota University.—A fund to be known as the A. D. Wilson prize fund is being collected by subscription in honor of the retiring director of extension work. The income of this fund is to be used annually in either the college or school of agriculture or both as prizes to students excelling in studies having to do with cooperation and cooperative enterprises.

W. C. Coffey, professor of sheep husbandry in the University of Illinois, has been appointed dean of the department of agriculture, beginning July 1. F. W. Peck, farm economist in charge of cost accounting and farm management in the U. S. Department of Agriculture, has accepted an appointment as director of agricultural extension vice A. D. Wilson, whose resignation has been previously noted.

M. H. Fohrman, superintendent of testing, has resigned and has been succeeded by E. O. Hanson, the former superintendent. E. L. Holmer has accepted an appointment in the department of farm management at the Iowa College and has been succeeded by H. B. Price, instructor in marketing in Yale University. W. E. Hoffman has been appointed instructor in economic entomology vice W. C. Cook, resigned. J. S. Jones has resigned as assistant State leader of county agents and was succeeded April 1 by Frank L. Brown, county agent of Murray County. Genevieve Burgan, instructor in textiles and clothing, has been appointed assistant State leader of boys' and girl's work.

Mississippi College and Station.—Dr. E. Barnett has been appointed head of the department of animal husbandry, and C. J. Goodell animal husbandman in the station.

Nebraska University and Station.—H. P. Davis, head of dairy husbandry work in the University of Idaho and vice director of the Idaho Station, has been appointed chairman of the dairy department of the university and station, effective August 1.

New Hampshire Station.—P. R. Lowry of Ohio State University has been appointed assistant entomologist, vice C. R. Cleveland.

New Jersey Stations.—A conference of agricultural workers in institutions in the eastern States and executives of the fertilizer industry was held at the station June 2 and 3. The program included an inspection of the soil and fertilizer investigations and an automobile tour of the leading agricultural sections of the State. Twelve agricultural colleges and experiment stations were represented, as well as the U. S. Department of Agriculture, the Soil Improvement Committee of the National Fertilizer Association, and others.

Cornell University and Station.—Several acres of wooded hillside near the present biological field station have been presented to the university by J. T. Newman, an alumnus. The new tract will be kept as a wild-life preserve for research and study.

Glista Ernestine, the world's record Holstein-Friesian cow in the station herd, has completed her seventh record of more than 30 lbs. of butter fat in seven days. Her latest record is 31.4 pounds.

The department of plant breeding is distributing 4 strains of oats and 2 of barley among the farmers of the State for further redistribution in the future. The oats have been named Cornellian, Standwell, Comewell, and Empire, and the barleys Featherston and Crossman.

Dean and Director Albert R. Mann has declined an election as State commissioner of farms and markets. L. G. Graves, professor of dietotherapy for the past three years, resigned July 1 to become superintendent of dietaries and professor of dietetics in the training school of the Mount Sinai Hospital in New York City.

New York State Station.—The following resolutions were recently adopted by the faculty of Cornell University:

"On the occasion of the retirement of Dr. Whitman Howard Jordan from the professorship of animal nutrition in Cornell University and from the directorship of the New York Agricultural Experiment Station at Geneva, the members of this faculty desire to record their appreciation of the inestimable service which Professor Jordan has rendered to science and to the scientific agriculture of the State and of the Nation.

"Professor Jordan assumed the directorship of the experiment station in 1896, a critical time for agriculture and for the new experiment stations. He brought to his work true scientific training, gained as an undergraduate student at the University of Maine, as a postgraduate student at Cornell University under the guidance of Professor Caldwell, and as an assistant to Dr. Atwater at the Connecticut Agricultural Experiment Station; and long experience as a teacher of agriculture and agricultural chemistry at the University of Maine and at the Pennsylvania State College, and as director of the Maine Agricultural Experiment Station. With this wealth of training and experience, in addition to his high scientific ideals, his indomitable courage, his unflagging zeal for truth, his sound judgment in the selection of associates, and his unswerving loyalty to the best interests of agriculture, he has made a profound and lasting impression on the agriculture of this State.

"The outstanding feature of his long service in the interest of agriculture has been his strict adherence to the dictates of science without regard to popular esteem or favor. Strong as the temptation has been for an administrator to popularize the work of his institution at the expense of its research, Professor Jordan, in his administration of the station, has held strictly to the original purpose and object of the institution uninfluenced by considerations of popular favor. Under his wise and capable administration, the New York Agricultural Experiment Station has attained a leading position among the agricultural experiment stations of the world.

"Professor Jordan's connection with this college as professor of animal nutrition dates only from June 22, 1920, but his interest in the institution and his hearty and cordial cooperation have extended through all the 25 years that he has been director of the experiment station at Geneva. Accordingly there has always existed between these two institutions such close and gratifying cooperation in the prosecution of investigation and research that their work has ever been supplementary and unnecessary duplication of effort has been avoided.

"In spite of all the multiplicity of duties which naturally come to an outstanding figure in agriculture, Professor Jordan has always found time to continue his own scholarly work in animal nutrition and to advise critically with members of his staff on a wide variety of highly technical subjects. His keenly analytical mind, his sound judgment, his unusual administrative ability, and, above all, his lofty personal ideals and breadth of vision, have endeared him to his colleagues and associates. He has richly earned the relief which retirement from active service brings, and we, his colleagues, wish him many years in which to enjoy the privileges of the contemplative life which is now his."

F. R. Clark, a recent graduate of the University of Michigan, has been appointed assistant in research (horticulture) and has entered upon his duties. Henry L. Young, assistant chemist, resigned July 15.

North Dakota Station.—R. L. Webster, formerly of the department of entomology of the Iowa College and Station and just completing work at Cornell University for the degree of Ph. D., has been appointed station entomologist, beginning early in August. C. E. Mangels, chemist in charge of vegetable and fruit dehydration investigations of the Bureau of Chemistry, U. S. Department of Agriculture, has been appointed cereal chemist, beginning about July 15. G. W. McIlroy and N. B. Guerrant, 1921 graduates, respectively, of the University of Wisconsin and Westminster College, have been appointed poultryman and assistant in agricultural chemistry, beginning July 1.

Pennsylvania College and Station.—The resignations are noted of R. R. Welch, professor of dairy husbandry extension, effective July 1, and Martin M. Kloser, instructor in bacteriology, effective July 15. R. M. Gridley, assistant professor of animal husbandry extension, and C. L. Rumberger, assistant in agricultural extension, have been appointed county agents. E. M. Christen has been transferred from instructor in animal husbandry to instructor in animal husbandry extension. R. Irving has been appointed instructor in animal husbandry extension, B. Wright instructor in agricultural extension, B. J. Haler assistant in forestry, and P. Koenig assistant in agricultural extension.

Vermont University.—The university has been given a notable oil painting of the late Senator Justin S. Morrill, painted when he was about 65 years of age. During the last 20 years of his life and the 20 years following this painting hung in his Washington home. The portrait has been placed in Morrill Hall, together with a picture of the senator's only son, James S. Morrill, also deceased. It is stated that none of the senator's blood in line of direct descent is now alive.

Virginia Truck Station.—F. H. Keister, assistant horticulturist, was drowned June 5 while surf bathing at Ocean View. Mr. Keister was an alumnus of the Virginia Polytechnic Institute and had been connected with the station since graduation in 1919.

Necrology.—Professor John Hamilton, widely known for his long connection with the Pennsylvania State College and the farmers' institute work of the Nation, died at State College, Pa., July 5 at the age of 78 years.

Professor Hamilton was a native of Pennsylvania and served as sergeant-major of the First Pennsylvania Cavalry from 1861 to 1864. Following the

Civil War he was commandant of the cadets of the college from 1869 to 1873, business manager from 1874 to 1886, and treasurer from 1874 to 1911. He receiver the degree of Bachelor of Science from the college in 1871 and that of Master of Agricultural Science in 1872. From 1871 to 1880 he was professor of agriculture in the college, deputy secretary of agriculture of Pennsylvania from 1895 to 1899, and State secretary of agriculture from 1899 to 1903.

In the latter year he became farmers' institute specialist in the Office of Experiment Stations in this Department, continuing in this capacity until his retirement from active duties in 1914. His unfailing interest and faithful service in the cause of farmers' institutes, both in Pennsylvania and in the entire country, and as secretary for many years of the American Association of Farmers' Institute Workers, will long be remembered.

Jacob H. Arnold, agriculturist in the Office of Farm Management and Farm Economics, U. S. Department of Agriculture, since 1914, died at Takoma Park, D. C., July 12. Mr. Arnold was born in Defiance, Ohio, in 1864, and graduated from Grinnell College, Iowa, in 1891. After 13 years' service as professor of mathematics, economics, and history in Redfield College, South Dakota, he took up farm management work in Kansas, and following his appointment with this Department made some of its earliest farm management and cost accounting surveys. He was the author of a number of publications issued by the Department and a treatise entitled Farm Management, published in 1919.

A New Practical School of Agriculture in Southern France.—There has been established recently, under the patronage of the Agricultural Society of France, a new practical school of agriculture known as the La Félicité Higher School of Agriculture, near the town of Aix-en-Provence, 18 miles northwest of Marseille, where a tract of 247 acres of land has been secured. The object of this school is to give instruction in the scientific methods of agriculture in order to train young men to become farm managers or to direct colonial farming enterprises. The directors hope that a certain number of American students may eventually enter the institution.

The instruction will be given in two annual sessions of ten months each, and will consist of certain technical studies, usually given in the evening, and of six main practical courses, to each of which the student will devote three months, as follows: The cultivation of farm and pasture land; prairies, irrigation, and drainage; the culture of gardens, orchards, and vineyards; animal husbandry; rural engineering, including tractors, farm machinery and implements, and rural construction; and farm management, including the organization and direction of farm work, intensive and extensive soil culture, costs of production, agricultural technology (enology, distilling, sugar production, oils, the conservation of fruits, vegetables, and meats, butter and cheese making, and the making of fertilizers on the farm), agricultural accounts, rural economics (farm credits, marketing of products, insurance, agricultural syndicates, rural banks, cooperation, etc.), rural legislation, administrative and political economy, sociology, philosophy, and religion. Applicants for admission must be 16 years of age and have completed the ordinary French scholastic courses. A certificate is awarded on completion of the course.

Belgian Exchange Scholarships in Agriculture.—Through the efforts of M. Paul de Vuyst, Director General of Agriculture in Belgium, six scholarships of one year each have been offered to American students. These scholarships include one each in the Institutes Superior d'Agriculture at Gembloux and Louvain; one each at the Écoles d'Horticulture de l'État at Ghent and Vilvorde, and two for women at Berlaes-Lierres near Antwerp. These scholarships have been offered with the expectation that similar arrangements will be made with the United States for an equal number of Belgian students. Additional details may be obtained from Editor of *World Agriculture*, Amherst, Mass.

Agricultural Education in the Orient.—It is planned to establish a second National University in China, with the greater part of Nanking Teachers' College as its foundation. The new institution will be located at Nanking, and it is hoped to open its doors this fall with a college of liberal arts and professional schools of agriculture, engineering, commerce, and education.

Press reports announce that the Maharajah of Bikaner, northwest India, has offered to convey to the Board of Foreign Missions of the Methodist Episcopal Church a tract of 10,000 acres of farm land as a site for an agricultural college and demonstration farm. The offer further includes the construction of all necessary buildings and payment of the salaries of the staff and operating expenses. It is stated that the offer will be accepted provided suitable agricultural experts can be obtained.

New Journals.—*Scientific Agriculture* has been established, beginning with January, 1921, as the official organ of the Canadian Society of Technical Agriculturists. The initial number deals quite largely with the organization and membership of the society, an account of which has been previously noted (E. S. R., 43, p. 401). It also contains numerous technical and popular articles on various phases of agricultural science. A French section, *La Revue Agronomique Canadienne*, issued as the official organ of the Société des Agronomes Canadiens, is appended to each number.

The American Journal of Hygiene "is to be devoted solely to the publication of papers representing the results of original investigation in the domain of hygiene, using the term in the broad sense to cover all applications of the mathematical, physiological, chemical, medical, and biological sciences to the problem of personal and public hygiene." At least six numbers, aggregating 600 pages, will be issued per annum. It is expected that provision will also be made for investigations of unusual length and interest in the form of Supplementary Monographs to be issued at irregular intervals.

Pysiological Reviews is announced as a new quarterly to be published by the American Physiological Society "to furnish a means whereby those interested in the physiological sciences may keep in touch with contemporary research." The journal is to consist of short comprehensive articles dealing with the recent literature in physiology, using this term to include biochemistry, biophysics, experimental pharmacology, and experimental pathology. Each article will be in the nature of a contemporary review of work, together with complete bibliographical lists, subjects being assigned by the editorial board.

The American Journal of Tropical Medicine is being published bimonthly as the official organ of the American Society of Tropical Medicine. The initial number contains the 1920 address of the president, Dr. Henry J. Nichols of the Army Medical School, a list of members of the society, and several original articles, including one on Natural Malaria Infection in Anopheles Mosquitoes, by W. V. King, of the Bureau of Entomology, U. S. Department of Agriculture.

Agricultural Engineering is being published as the monthly organ of the American Society of Agricultural Engineers. The initial number contained articles on Standardization of Farm Equipment, by R. Olney; Hardening Soft Center Steel Plow Shapes, by C. W. Rynders; Plantation Management from the Inside, by S. F. Morse; and several shorter articles, notes, etc.

EXPERIMENT STATION RECORD.

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Many of the features now embraced in the subject of agricultural engineering have found employment in the art since early times. In a large measure the application of engineering in agriculture has increased with the advance of the industry, and in many instances it has been the primary cause of epoch-making progress. But as a recognized branch of agricultural teaching its organization is relatively recent, and as a subject of investigation it has not yet become widely established. In the latter respect it may be said to have lagged behind several related branches which are hardly of less fundamental importance.

The development of implements, machinery, and mechanical power to make man's efforts more effective and more productive is one of the most prominent features in progress; a better structure and more effective building and storage facilities are everywhere a mark of such progress. Add to these features the application of water to the soil where and when needed, its removal where present in excess, the subduing of land otherwise unfit for cultivation, and the provision of the facilities of the modern country home, and it will be evident what a large part rural engineering plays in the process of gaining and exercising dominion over the earth.

In recent years this branch has been steadily making its way, first as a teaching subject, then as a service branch, and gradually taking its place in the field of investigation. This latter development is not only logical, but is one of the features which at the present time are deserving of special encouragement. There can be no question that the purely mechanical and rule-of-thumb methods which have been followed need to be subjected to the same rigid scrutiny that other branches of farming have received. That the opportunity is open hardly needs argument. It is already recognized that tools and implements built and operated without mechanical or mathematical precision often embody undesirable features such as lost motion, wasted energy, or lack of durability or reliability, and in some cases are not fully adapted to the needs sought. Indeed these ends are themselves not always clearly understood. Building and storage structures planned and erected without consideration for warmth, light, and ventilation, to say nothing of strength and durability, have proved uneconomical and inadequate. They do not take account of the advances which science has taught in the storage of crops, the housing of stock, and the care of dairy animals. Thus in order to keep abreast of the times it has become necessary to seek out and apply engineering principles in the development of the mechanical, electrical, hydraulic, and other engineering processes involved in modern farming, and to adapt these to the modern teaching of agricultural science.

In the beginning of agricultural engineering old and well established engineering principles were naturally applied as far as possible, but it soon developed that the problems of agriculture requiring engineering treatment are more or less specialized. They present conditions and requirements which are of a special nature, which have to be taken into account. This brings out the advantage of the agricultural outlook and contact, and at the same time it presents the opportunity for investigation immediately adapted to the situation. Certain of the engineering principles and formulas originally used are found to need intelligent modification or development, and again new facts and special information must be established to meet the requirements in many special cases.

While considerable progress has been made in providing a broad background and to some extent in the formulation of purely agricultural engineering principles, the development of inquiry along advanced lines has been relatively limited, and there is a feeling among some that this branch has not kept pace with the rapid advance in other branches of agricultural science. It is undoubtedly true that, from the nature of the situation, considerable of the activity in agricultural engineering has consisted of teaching, extension, and expert service, rather than a searching after and disclosing of new information. The fact that there is a demand for the former is proof that at least some of the latter should be developed, to lead the way and stimulate gradual advancement in the subject. This will require opportunity—not only facilities, but time and freedom and a sustaining support which will encourage and give protection. Manifestly in a new subject like this various types of activity will be needed, just as they have been in horticulture and agronomy and other branches. It will be useful to make comparative trials, to apply known facts and principles in designing appliances and structures, to employ the skill and judgment of the engineer in a variety of ways to matters which have a bearing on agriculture; but without losing sight of the agricultural connection or purpose, a certain amount of investigation or carefully considered research will be a means of growth and enable rank to be taken with other departments of agricultural science.

A survey of the project lists of the experiment stations shows a relatively small number of projects in the field of engineering. The majority of these are rather elementary, relating to design of structures, comparisons of implements or methods, surveys for engineering enterprises, and the like. There is no intention, of course, to disparage any of these, but the record shows very few projects of actual research grade. As a matter of fact, no project in agricultural engineering has ever been submitted for the Adams fund, a fact which, although it does not necessarily indicate the absence of such projects, suggests that the field has attracted but little attention.

Research is often used in a rather loose and broad sense. It may very properly be reserved for types of effort which, besides being systematic aim at something more than comparisons, involving originality in procedure or in the end product, and as a rule resulting in facts rather than in material things. It is well to maintain these distinctions in agricultural engineering. Standards, of course, advance with the progress of the subject, and what is recognized as research at one stage will lack the essential qualities at a later stage because of the progress which others have made. It will be well to recognize research in agricultural engineering as the pursuit of knowledge having a basis in science, not merely the means of testing or perfecting a particular mechanical device. It aims to consider all the factors and principles involved and the purpose sought to be accomplished, as well as the mechanical ingenuity involved in the product. It must naturally take into account the purpose which is to be accomplished by the appliance or operation, and this often brings engineering research into intimate relation with other branches of agricultural science. Progress is the watchword of research, and research is the basis of advancement of any branch of pure or applied science. Unless agricultural engineering can be developed as a research subject, it will lag behind, will borrow its fundamentals from physics, chemistry, agronomy and other branches, and will be in danger of remaining largely a service department occupied with the application and adaptation of what is known and its teaching. To secure a certain degree of independence and to grow of its own effort, the subject ought to have the elements of growth within itself, and these need to be visualized and set in motion by leaders in that field.

The formation of the American Society of Agricultural Engineers was a recognition of the position this subject has attained and the need of organized means for advancement. It has given a decided impetus to investigation in that line and has tended toward the development of methods and the setting up of standards.

For several years the society has had a research committee which has been engaged in determination of the status of scientific information, the analysis of needs for research, and the formulation of methods of procedure in the plan and execution of specific projects. This study has developed a considerable record of inquiry extending back for a quarter of a century, from which has been derived a considerable part of the basic facts and principles upon which present knowledge of agricultural engineering rests. Some of the hydraulic formulas used in irrigation and drainage are illustrations of the results of this work, and it is also reflected in the development of certain farm machinery and other appliances.

The study has also disclosed a large amount of simple testing and experimentation resulting in data for the most part of rather limited application and less permanent value. This is particularly true in the case of certain matters relating to rural sanitation, and in the farm machinery field much of the experimentation has been of relatively limited fundamental character in proportion to the importance of the subject and the opportunity offered. It is found that too often such work has apparently lacked definiteness of plan and fundamental aim, or has been conducted to meet a superficial need rather than to derive broad general facts. The character and the paucity of the work in some directions, it is believed, has tended to retard the progress of agricultural engineering as a teaching subject and along applied lines.

One important feature in the development of investigation in such a subject is a survey of the field in order to determine the most desirable lines along which investigation should be conducted at the present time and to provide bases from which to operate. Such a survey naturally deals largely with the available scientific information and the technical and economic conditions involved. It thus opens up avenues for profitable inquiry and directs attention to the types of problems and the character of work especially needed.

This the research committee of the society, working in connection with the college section of that organization, has for some time been engaged in, and has brought forward some fifty specific lines along which investigation and experiment are deemed desirable. The subjects embraced include all of the main branches of agricultural engineering, and have been selected as the most pressing and the most representative of agricultural interests throughout the United States. The work of the committee has not only established the need of determining underlying facts and principles in a number of lines and establishing the influence of prevailing conditions, many of which are now more or less speculative in character, but it has pointed to the importance of planning and executing projects with a definite aim in each instance.

Inquiry in this subject, as in all others, must be planned and conducted with vision and understanding of the real nature of the problem to be solved. Unless this is done the end sought may not be a profitable one or the work may be of purely tentative value. For example, it would be well-nigh useless to derive a formula for a plow moldboard until it was scientifically clear what a moldboard was designed to accomplish in a given soil or for a certain purpose. The purpose sought to be accomplished is the proper starting point in designing, perfecting, or testing an implement; but it will be recognized that it is a point frequently neglected, with the result that the planning is faulty and the results give divergence of opinion. There is a profitable field for study of the theoretical basis of plowing, and such a study would involve a group of several agricultural specialties.

The complex nature of the problems in agricultural engineering emphasizes the need of the same broad preparation and inculcation of the research spirit which prevail in other lines of advanced inquiry. There is need in that subject of understanding which rests on principles and the relation of conditions, as well as the requirement of facts and skill and ingenuity. In the training of agricultural engineers stress is naturally laid on ability to do things, to apply rules, to be resourceful in meeting specific conditions effectively. Attention is less rarely given to training in the acquisition of knowledge which is new, in questioning the reason for a process, or raising a doubt as to an empirical fact. The difference between experience and sound practical judgment on the one hand, and investigation directed toward the establishment of new scientific facts or a better understanding of principles and relationships on the other, is as great in agricultural engineering as it is in agronomy or animal feeding; and the development of the proper attitude is as essential to success in engineering research as it is in any other branch of scientific or technical inquiry.

The requirements for successful investigation are somewhat different from those of engineering practice. The planning and execution of scientific inquiry calls for the exercise of vision, the knowledge of the means of solving scientific problems, and the spirit which demands to know the meaning of the fact as well as the bare fact itself. Hence the individual engaged in the planning and execution of research in agricultural engineering needs not only to be trained in engineering matters but to be trained in research, its methods and spirit as well; he needs to have both the time and the patience for his investigations to make them thorough and searching.

The strengthening of investigation in this field will call for the formulation in their research aspects of some of the things which need to be done. If there are problems to be solved which depend on more fundamental inquiry, on the development of methods which will give more trustworthy or more intimate knowledge of the facts and conditions involved, it should be possible to formulate these so that they will stand out with force, and thus to open up the field. The setting forth of the real nature of the questions which come to the engineer will serve to illustrate best of all the essential features involved in scientific inquiry and will prepare the way for leadership in developing the field. Some of these problems will be so broad in their fundamental character that they will require the help of specialists in other lines, and will thus lead to cooperation; in this the engineer need not play an incidental part, but ought to be able to contribute something which none of the other specialists can.

The American Society of Agricultural Engineers has a highly useful function in guiding and stimulating inquiry and in paving the way for cooperation. It represents a viewpoint which should serve to bring out important questions likely to be overlooked by specialists in other branches. It can emphasize the importance of engineering being taken into account in connection with various other problems of a comprehensive nature. Already the society is attempting to establish better cooperative relations between Federal and State agencies, between institutions in different States, and between the agencies within individual States which have common interests in agricultural engineering questions. On the basis of topics which its survey has shown to be important it will develop plans of procedure which will be subjected to the critical scrutiny of its committees and of the society as a whole. Such an organized effort as this is of no small interest to the agricultural experiment stations, many of whom are represented in the society, and it will likewise be of much interest to station directors in setting forth the field and the desirability of development in that line of inquiry.

The provision thus far made for investigation in agricultural engineering at most of the experiment stations is relatively small. In the majority of cases the engineers are largely engaged in teaching and extension work, or in designing structures or plans to meet the needs of applicants. The actual experimental work occupies a rather subordinate position, in spite of the fact that both the teaching and extension work depend largely upon the results of research for their progress and development. The result is that the engineer does not have the opportunity and is not always given the encouragement for digging deep and supplying an increasingly broad and strong foundation for his speciality. This may sometimes be due to his own inclinations or preferences and sometimes to the conditions under which he works, but until both the need and the ability are shown for more fundamental investigation in engineering support may be relatively slow to materialize.

There is undoubtedly opportunity and need for a type of study which will go beyond comparisons, will attempt to trace the true relation between conditions and results, will make engineering as applied to agriculture less empirical and rest it in a larger measure upon facts and principles which it is itself helping to establish. It is recognized, of course, that for a time at least much of the work of the agricultural engineer must of necessity be of rather elementary nature and immediately practical aim, and will rest in considerable measure upon his general information, mechanical ability, and practical qualities. But if this specialty is to grow it must be through research which is searching and severe, and the department must not be exclusively a teaching and service department or restricted wholly to practical affairs.

This will require that agricultural engineers be given the same consideration as other branches of agriculture in the provision of funds and facilities. Both men and opportunity will need to be provided. In general, perhaps, the specially trained personnel will not be forthcoming until the opportunity presents an attractive field. In some instances it may be necessary to train men in part, or to adapt specialists to this field in order to work out certain types of problems. The opportunity for leadership both in planning and in execution would seem to be a large one.

RECENT WORK IN AGRICULTURAL SCIENCE.

AGRICULTURAL CHEMISTRY—AGROTECHNY.

Yearbook of chemistry, edited by R. MEYER (*Jahrb. Chem., 24 (1914), pp. XI+478; 25 (1915), pp. XII+454; 26 (1916), pp. XII+481, fig. 1; 27 (1917), pp. VII+272; 28 (1918), pp. VII+267, figs. 2*).—These volumes contain reports of the progress in pure and applied chemistry for the years 1914–1918, inclusive, in continuation of the series previously noted (E. S. R., 32, p. 801).

Popular chemical dictionary, C. T. KINGZETT (*London: Baillière, Tindall & Cox, 1920, pp. VI+368, figs. 76*).—This dictionary contains definitions and explanations of chemical laws and processes, descriptions of the chemical elements and the more important inorganic and organic compounds with their preparation or manufacture and applications, and illustrated descriptions of various chemical apparatus.

Chemical French, M. L. DOLT (*Easton, Pa.: Chem. Pub. Co., 1920, 2. ed., pp. VIII+413*).—A few minor changes, corrections, and additions have been made in this revision (E. S. R., 39, p. 418).

Laboratory manual of elementary colloid chemistry, E. HATSCHEK (*London: J. & A. Churchill, 1920, pp. 135, figs. 20*).—This manual gives detailed directions for carrying out the fundamental operations of colloid chemistry, and for making a number of representative preparations and examining them by the standard methods.

Chemistry and the food industry, C. L. ALSBERG (*Chem. and Metall. Engin., 23 (1920), No. 21, pp. 1005–1007*).—This is a brief discussion of various chemical problems relating to the industries that use agricultural raw materials.

The chemistry of succulent plants, K. BRANHOFER and J. ZELLNER (*Hoppe-Seyler's Ztschr. Physiol. Chem., 109 (1920), No. 1, pp. 12–15*).—In this paper, which supplements a previous contribution by Zellner (E. S. R., 40, p. 710), analyses are reported of the leaves of several succulent plants, including *Sedum telephium*, *Sempervivum hirtum*, *Euphorbia coerulescens*, *Opuntia monacantha*, and *Aloe vera*.

The results in general confirm the earlier observations of a low content of iron and a high content of water-soluble material, calcium malate, and reducing sugar, although the latter was almost completely absent in Opuntia. A low nitrogen content did not prove to be the rule. A point not brought out in the previous study is the almost complete lack of tannin in all of the plants examined.

Continuation and extension of work on vegetable proteins, T. B. OSBORNE and L. B. MENDEL (*Carnegie Inst. Wash. Yearbook, 19 (1920), pp. 389–401*).—This is the annual progress report (E. S. R., 43, p. 409) of work on vegetable proteins and vitamins, the detailed reports of which have been previously noted from other sources.

The chemistry of enzym actions, K. G. FALK (*New York: Chem. Cat. Co., Inc., 1921, pp. 136*).—This is the first of a series of scientific and technologic monographs on chemical subjects to be published under the auspices of the American Chemical Society.

The method of treatment adopted by the author is essentially a discussion of the progress which has been made in the investigation of enzyms along the lines of the kinetics of enzym action and the study of enzyms as substances possessing definite chemical structures or configurations. Throughout the book it is emphasized that enzyms "are to be considered as chemical substances which obey the laws of chemistry and whose actions are explainable by the theories in vogue." The last 2 of the 10 chapters into which the book is divided deal with the uses and applications of enzyms and a general summary of the present status of the enzym problem.

Chemical investigation of amylases and related enzyms, H. C. SHERMAN (*Carnegie Inst. Wash. Yearbook, 19 (1920), pp. 338–340*).—This annual progress report of investigations of amylase and related enzyms (E. S. R., 43, p. 311) includes a brief report of an extension of the study of the effects of amino acids upon the enzymic hydrolysis of starch (E. S. R., 42, p. 203) to glycin, alanin, phenylalanin, and tyrosin. The data reported for these four amino acids show a general similarity to the previously reported data for asparagin and aspartic acid.

"Allowing for divergences attributable to experimental error, it appears that the effect of amino acid in facilitating the enzymic hydrolysis of starch is similar, but not necessarily identical, for the different amino acids thus far investigated; that it is somewhat greater for the purified form of the enzym than for the natural or commercial material in which the enzym is accompanied by other constituents of the tissue or secretion in question; and that it is greater for the pancreatic and salivary amylases than for the amylases of malt and of *Aspergillus oryzae*. In general, the addition of a mixture of two amino acids gives practically the same effect as would result from a corresponding concentration of one of them."

In discussing the nature of this effect evidence is furnished that the favorable influence may be due partly to a protection of the enzym from deterioration in the aqueous dispersions in which it acts. Evidence is also furnished that amino acids are effective in protecting the enzym from the deleterious action of an inhibitory agent such as copper.

"In addition to protecting the enzym from gradual deterioration under the influence of the water in which it is dispersed, or from inhibition by certain actively deleterious substances if present, amino acids may or may not literally activate the enzymic hydrolysis by directly facilitating or accelerating the interaction of enzym and substrate, or they may function by sustaining the activity of the enzym through combining with some product or products of the enzym action, which products might otherwise combine with the enzym itself, thus reducing its activity, or might if remaining free in the solution tend to bring the hydrolysis to equilibrium. Experiments designed to throw further light upon these points are now in progress."

Methods of analysis and laboratory control (*Denver: Great West. Sugar Co., 1920, pp. VI+259*).—This reference book, prepared for the laboratories of the Great Western Sugar Co., includes directions for the process control of beet sugar manufacture, and methods for the analysis of raw material and sugar house products and for foods and feeding stuffs, cottonseed cake, and soils. Several of the methods in the latter group are those of the Association of Official Agricultural Chemists.

Standards and tests for reagent chemicals, B. L. MURRAY (*New York: D. Van Nostrand Co., 1920, pp. X+385; rev. in Jour. Indus. and Engin. Chem., 12 (1920), No. 10, pp. 1035, 1036*).—This reference book on the more important reagents used in factory and other laboratories deals with about 300 substances. The formula, molecular weight, important properties, maximum limits of impurities, and methods of testing these substances are given, together with valuable information concerning precautions to be taken in storing and dangerous and unpleasant properties of certain of the substances. Several useful tables are appended, including the percentages of different acids corresponding to the specific gravity of their solutions.

A study of some biochemical tests.—II, The Adamkiewicz protein reaction. The mechanism of the Hopkins-Cole test for tryptophan. A new color test for glyoxylic acid, W. R. Fearon (*Biochem. Jour., 14 (1920), No. 5, pp. 548–564*).—In this paper, which is the second of a series of studies of biochemical reactions (E. S. R., 40, p. 114), a new color test for glyoxylic acid is described, depending on its action with pyrogallol in the presence of H_2SO_4 with the formation of a deep blue color. Under the same conditions aliphatic aldehydes give various shades of red. By means of this test it is shown that the Hopkins-Cole test for tryptophan is due to glyoxylic acid and the Rosenheim test to formaldehyde.

Salicylic aldehyde in a 10 per cent solution in alcohol is suggested as a simple quantitative reagent for tryptophan and the indols. On warming a mixture of the substances to be tested and strong HCl with a few drops of the reagent, followed by a drop of 10 per cent hydrogen peroxid, an intense blue color is formed with tryptophan, a deep purple color with scatol, and a bright carmine with indol. The color is said to be produced with less than 0.1 per cent of tryptophan.

The paper also includes a brief discussion, with suggested formulas, of the condensation derivatives of tryptophan which make up the pigments.

Microreduction methods, D. G. C. Tervaert (*Hoppe-Seyler's Ztschr. Physiol. Chem., 110 (1920), No. 1, pp. 41–54*).—The author discusses the Bang micro method for the determination of blood sugar and the potassium dichromate method for the determination of blood fat or lipoids (E. S. R., 41, p. 116), and describes an application of the latter method to the determination of glucose, lactose, and maltose. The technique is as follows:

The equivalent of from 0.2 to 0.4 cc. of a 1 per cent solution of the sugar to be tested is mixed in a 100 cc. Erlenmeyer flask with 1 cc. of N/20 potassium dichromate and water to make a volume of 6 cc. Four cc. of H_2SO_4 is added and the flask heated on the water bath for 30 minutes, after which it is cooled, and 50 cc. of distilled water and 1 cc. of 5 per cent potassium iodid solution are added. After standing a minute the solution is titrated with standard thiosulphate. The difference between the titration value and that of a blank treated in the same way gives the reducing value of the solution.

Values obtained for the reducing sugars in blood by this method are higher than with the copper method. Added sugar is quantitatively recovered from the blood.

The quantitative determination of selenium, F. Wrede (*Hoppe-Seyler's Ztschr. Physiol. Chem., 109 (1920), No. 6, pp. 272–275*).—The method recommended by the author consists in the oxidation of the substance in the presence of platinum as a catalyzer and the titration of the selenic acid thus formed with N/100 NaOH, using methyl orange as an indicator. In determining sulphur in the presence of selenium the total acidity is titrated and the H_2SO_4 then determined gravimetrically as barium sulphate. The difference between the total acidity and the acidity calculated from the $BaSO_4$ represents the selenic acid. In the presence of nitrogen or the halogens the selenic acid, instead of being titrated, is reduced with sodium sulphite in strong HCl solution and determined gravimetrically.

The method, the technique of which is described in detail, is said to require only very small amounts of material and to be quite rapid of execution.

Mustard oil as a preservative of milk, P. Post (*Pharm. Weekbl., 58 (1921), No. 5, pp. 131–138*).—Mustard oil in the proportion of 20 drops to 1 liter of milk is suggested as a preservative for milk samples to be used for analysis. Experimental data are presented which indicate that the addition of the oil has no effect on any of the customary determinations except freezing point, lactose, protein, and catalase. Correct results may be obtained in freezing point determinations by shaking the sample with 10 per cent of sesame oil and in the lactose determinations by shaking three times with petroleum ether. By adding to 10 cc. of the milk 5 cc. of alcohol and evaporating to a final volume of 5 cc., the mustard oil is driven off and correct protein determinations can be made. Catalase is destroyed by mustard oil, so that catalase determinations can not be made on milk samples to which this has been added.

Factors influencing coagulation temperature in evaporated milk, L. A. Rogers (*Canner, 52 (1921), No. 10, pp. 165, 166, figs. 3*).—The author, from the Dairy Division, U. S. Department of Agriculture, discusses the conclusion drawn by Sommer and Hart (E. S. R., 42, p. 208) that the chief factor in the heat coagulation of fresh milk is the composition of the milk salts. He shows that, while this may be true of fresh milk from individual cows, in herd milk other factors enter in which have so great an influence on the curdling temperature that the effect of the composition of the salts is almost entirely obscured. Of these factors the most important is considered to be the growth of bacteria, not only of acid-forming types but of types which produce a rennin or milk-curdling enzym without increasing the acidity of the milk. Experiments are cited in illustration of the points brought out.

The iodometric determination of copper and its use in sugar analysis, P. A. Shaffer and A. F. Hartmann (*Jour. Biol. Chem., 45 (1921), No. 2, pp. 349–390, figs. 4*).—Two papers are presented.

I. *Equilibria in the reaction between copper sulphate and potassium iodid* (pp. 349–364).—In this paper are reported the results of a determination of the points of equilibria of the reaction

$$CuSO_4+nKI=CuI+I_2+K_2SO_4$$

at ratios of from 1 to 10 KI : 1 $CuSO_4$ at various dilutions with a view to the utilization of the reaction for the accurate determination of either cuprous or cupric salts. The procedure consisted in mixing the solutions of $CuSO_4$ and KI in definite molecular ratios at widely varying concentrations, and after standing at room temperature pipetting samples of the supernatant liquid directly into an equal volume of water containing an excess of NaOH to precipitate the cupric copper. This was removed by filtration and the iodin determined by acidifying the filtrate and titrating with thiosulphate. The experimental data thus obtained indicate that for the determination of cupric salts potassium iodid must be added to give a final concentration of about 0.25 M (4 to 5 gm. per 100 cc. of solution). For the determination of cuprous salts the solution must be so diluted that the final concentration of copper and of iodid does not exceed about 0.005 M each.

It is noted that the conditions found empirically by Gooch and Heath[1] for cupric salts and by Maclean (E. S. R., 41, p. 505) and Scales (E. S. R., 34, p. 611) for cuprous salts comply with these requirements.

II. *Methods for the determination of reducing sugars in blood, urine, milk, and other solutions* (pp. 365–390).—It is pointed out that the method of titration of cuprous copper as noted above is limited in its usefulness on account of the extreme dilution required, and attention is called to the possibility of reducing the concentration of cupric ions to a negligible value by the addition of alkaline oxalates, thus enabling one to direct the reversible action to completion in either direction at will. The cupric salt is first completely reduced and precipitated as cuprous iodid in the presence of a large excess of soluble iodid and the liberated iodin reduced to iodid on titration with thiosulphate. On the addition of more free iodin and potassium oxalate the cuprous iodid is at once dissolved and oxidized by the free iodin, and is not affected by the removal of the excess of free iodin in a second titration with thiosulphate. This makes it possible to determine the amount of copper reduced by sugar either by "cupric titration," the method based upon the determination of the residual cupric salt by its reaction with an excess of KI, or by "cuprous titration," the determination based upon the reoxidation of cuprous salt by iodin made possible by the action of the alkaline oxalate.

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[1] [illegible] 24 (1907), No. 139, pp. 65–78.

The technique is described in detail for the two procedures as applied to the determination of large amounts of reducing sugar and of small amounts as in milk, blood, and urine.

The iodometric estimation of sugars, J. L. Baker and H. F. E. Hulton (*Biochem. Jour., 14 (1920), No. 6, pp. 754–756*).—The authors confirm the conclusion of Judd (E. S. R., p. 507) that the method of Willstätter and Schüdel for the iodometric estimation of sugar yields good results. In practice it has been found necessary to employ an excess of iodin and alkali beyond that required by the equation and to mix the reacting solutions in the order of sugar, iodin, and alkali. It has been found possible to reduce the time required for the reaction from the 20 minutes originally recommended to 5 minutes. Attention is called to the fact that proteins are oxidized by iodin, and that if the method is to be used for the analysis of solutions other than pure sugars, the disturbing effect of proteins and other impurities will have to be considered.

The analysis of maple products.—II, The composition of maple sirup and of maple sugar sand and the detection of adulteration of the sirup, J. F. Snell (*Roy. Soc. Canada, Proc. and Trans., 3. ser., 13 (1919), Sect. III, pp. 221–231*).—This summary of the results of investigations of the author (E. S. R., 35, p. 416) and others on the composition of maple products and their adulteration has been essentially noted from another source (E. S. R., 44, p. 414).

The determination of sodium in blood, E. A. Doisy and R. D. Bell (*Jour. Biol. Chem., 45 (1921), No. 2, pp. 313–323*).—For the determination of sodium in blood the authors make use of the method of precipitation with cesium bismuth nitrite described by W. C. Ball,[2] the complex sodium cesium bismuth nitrite being capable of precipitation from as small an amount of sodium as 0.01 mg. in final volume of 2 cc. The technique of the method is described in detail, using gravimetric, volumetric, or colorimetric procedures for the final estimation of the nitrite. The colorimetric estimation is based on the coupling reaction of the nitrite with naphthylamin and sulfanilic acid, and the volumetric on the oxidaton to nitrate on titration with standard potassium permanganate. The volumetric method is preferred by the authors as being of greater speed and accuracy.

Tables are given showing the sodium content of normal urine and of beef and swine blood as determined by this method.

Apple candy, a commercial use for cull apples, T. H. Abell (*Utah Sta. Bul. 179 (1921), pp. 3–14, figs. 6*).—Following the suggestion of James (E. S. R., 39, p. 16) that a palatable candy-like product can be made from apples by drying thin slices mixed with sugar, the author has developed a method of treatment which is said to yield a very satisfactory product.

The method consists in grinding in a food chopper previously washed, peeled and cored apples, adding granulated sugar in the proportion of 15 lbs. to 100 lbs. of the chopped apples, spreading the mixture in thin layers on drying trays and evaporating for from 36 to 48 hours in a tunnel-type evaporator at a temperature of from 90 to 120° F. The dried product, known as apple leather, can be stored as such or ground in a food chopper, the resulting product being known as apple paste. In making the so-called apple candy a sirup made from 3 lbs. of sugar and 1 qt. of water is stirred into 4 lbs. of the dry apple paste and the product molded into any desirable form and allowed to harden slightly before use. This process is considered practical for the utilization of small blemished apples which would otherwise not find a market.

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[2] Jour. Chem. Soc.

The soy-bean problem, D. M. ADKINS (*Sci. Prog.* [*London*], *15* (*1921*), *No. 59, pp. 445–451*).—A popular article on the utilization of the soy bean and its by-products.

To make olive oil at home, C. H. BEAUMONT (*Jour. Dept. Agr. So. Aust., 24* (*1921*), *No. 6, pp. 489, 490*).—Directions are given for the home manufacture of olive oil on a small scale.

METEOROLOGY.

On the possibility of forecasting the summer temperature and the approximate yield of rice for northern Japan, T. OKADA (*Japan Bul. Cent. Met. Observ., 3* (*1919*), *No. 1, pp. 19–32, pl. 1; abs. in Internatl. Inst. Agr.* [*Rome*], *Internatl. Rev. Sci. and Pract. Agr., 11* (*1920*), *No. 2, pp. 148–150*).—It is pointed out in this article that in northern Japan the yield of rice is determined by the general summer temperature, especially that of August, a uniformly high temperature with abundance of sunshine during this month insuring a good rice crop.

The author attempts to find a basis for forecasting the summer temperature of northern Japan in the correlation between these temperatures and the barometric variations observed in March at Zikawei, China, and Miyazaki, on the southeastern coast of the island of Kiushiu, and during March to May at Santiago, Chile, and Buenos Aires, Argentina. He shows a positive and strong correlation between barometric variations at these places and summer temperature in the north of Japan, and concludes from this fact that a poor rice crop in northern Japan is preceded in most instances by a very low barometric pressure over South America during the period March to May and by a very slight gradient during March at the two other places named.

Meteorological observations at the Massachusetts Agricultural Experiment Station, J. E. OSTRANDER and H. W. POOLE (*Massachusetts Sta. Met. Buls. 387–388* (*1921*), *pp. 4 each*).—Summaries of observations at Amherst, Mass., on pressure, temperature, humidity, precipitation, wind, sunshine, cloudiness, and casual phenomena during March and April, 1921, are presented. The data are briefly discussed in general notes on the weather of each month.

Meteorological records for 1919 (*New York State Sta. Rpt. 1919,* [*pt. 1*], *pp. 533–545*).—Tables are given showing tridaily readings at Geneva, N. Y., of standard air thermometers for each month of the year; daily readings of maximum and minimum thermometers at 5 p. m. for each month of the year; a monthly summary of maximum, minimum, and standard thermometer readings for the year; monthly and yearly maximum and minimum temperatures from 1883 to 1919, inclusive; average monthly and yearly temperatures since 1883; and rainfall by months since 1882.

Ohio weather for the year 1919, W. H. ALEXANDER and C. A. PATTON (*Ohio Sta. Bul. 345* (*1920*), *pp. 479–570, figs. 62*).—Tables showing temperature and rainfall for the entire State in comparison with similar data recorded at the experiment station at Wooster are supplemented by a series of diagrammatic maps showing the comparative weather conditions for the various sections of the State.

The mean temperature for the year at the station was 51.2° F.; for the State 52.3°. The highest temperature at the station was 95°, July 3; for the State 106°, July 20. The lowest temperature at the station was —4°, December 20; for the State, —12°, December 20. The annual rainfall at the station was 43.08 in.; for the State, 40.33. The number of rainy days at the station was 132; for the State, 117. The prevailing direction of the wind was southwest at the station and northwest in the State at large.

"The year was characterized by a large amount of fine, open weather with abundant sunshine, moderate temperatures, and well-distributed precipitation, and was unusually free from extreme or hurtful conditions, the weather as a rule being highly favorable to the growth of crops and to farm work except toward the end of the year, when field work was interrupted more or less by the continuous rains. Practically the only abnormal conditions worthy of mention were the light snowfall in January and the excessive rainfall in October. In fact, it was the wettest October in the past 65 years and was among the warmest as well."

The rainfall of 1920 (*Met. Mag.* [*London*], *55* (*1921*), *No. 660, pp. 277, 278*).—This is a preliminary survey of rainfall of the British Isles during the year.

SOILS—FERTILIZERS.

The chemistry of crop production, T. B. Wood (*London: Univ. Tutorial Press, Ltd., 1920, pp.* [*3*]+*193, figs. 11*).—Those scientific principles of crop production relating to the soil and soil fertility are briefly set forth in this book. The author assumes a knowledge of elementary chemistry and of physical and chemical manipulation on the part of the reader. The subjects covered are the factors of productivity of the soil; sampling the soil, mechanical analysis, and soil types; the water supply of crops and cultivation; the supply of water to crops, weather; various soil constituents; chemical examination of crops and soil; testing the soil, nitrogen; testing the soil, phosphoric acid and potash, retention of manures in the soil; testing the soil, lime; nitrogenous manures; phosphoric acid manures; potash manures, lime, chalk, and marl; farmyard manure; nitrogen fixation and green manuring; the general principles of manuring; and the produce of the land.

The Missouri Soil Survey, H. H. Krusekopf (*Missouri Sta. Circ. 104* (*1921*), *pp. 20, figs. 20*).—A brief description is given of the work of the Missouri Soil Survey, which is operating in cooperation with the Bureau of Soils of the U. S. Department of Agriculture. It is stated that through this cooperative arrangement 45 counties, representing a total of 28,688 square miles, or 41.7 per cent of the State, have been surveyed and mapped. During this work 591 complete soil samples, consisting of 1,513 individual samples from 69 counties, have been secured. These indicate the diversity of the soils of the State, more than 174 distinct and separate soil types belonging to 70 series having been established and mapped. The laboratory studies made incidental to the soil surveys have shown that Missouri soils are deficient in organic matter and nitrogen and more or less deficient in phosphorus. Most of the light-colored prairie soils and the timbered ridge lands have a lime requirement of from 1 to 4 tons per acre.

Soil survey of Louisa County, Iowa, L. V. Davis and J. A. Elwell (*U. S.*

survey, made in cooperation with the Iowa Experiment Station, deals with the soils of an area of 253,440 acres in southeastern Iowa. The county consists of two areas of upland and two of lowland. The drift plain uplands have ample surface drainage while the first bottoms are usually subject to overflow, requiring levees and ditch systems. Approximately 60 per cent of the county is upland, 20 per cent terrace, and 20 per cent first bottom. The soils of the county are of loessial, glacial, and alluvial origin. Including river wash and muck, 28 soil types of 13 series are mapped, of which the Clinton, Tama, and Grundy silt loams cover 17, 10.5, and 10.4 per cent of the area, respectively.

Soil survey of the Aroostook area, Me., L. A. Hurst et al. (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1917, pp. 44, pls. 4, fig. 1, maps 2*).—This survey, made by the Bureaus of Soils and Plant Industry in cooperation, deals with the soils of an area of 697,600 acres in northern Maine covering the extreme eastern part of Aroostook County. The topography is undulating to hilly with a few low mountains, and the surface is characterized by high, level to undulating ridges, with long sweeping slopes. The area for the most part is naturally well drained. Practically all of the soils of the area are derived either directly or indirectly from glacial materials. Including muck, 15 soil types of 8 series are mapped, of which the Caribou loam, muck, and Washburn loam cover 55.9, 16.2, and 10 per cent of the area, respectively.

Soil survey of Knox County, Mo., H. H. Krusekopf and H. I. Cohn (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1917, pp. 32, pl. 1, fig. 1, map 1*).—This survey, made in cooperation with the Missouri Experiment Station, deals with the soils of an area of 328,960 acres in northeastern Missouri lying entirely within the northeast Level Prairie. The topography varies from level prairie to rolling timberland. The stream bottom soils are subject to overflow. The soils of the area are grouped as prairie, glacial, residual, and alluvial, the parent materials being mainly loess and glacial drift. Eighteen soil types of 12 series are mapped, of which the Shelby loam, the Grundy silt loam, and the Putnam silt loam covers 23.5, 21.2, and 16 per cent of the area, respectively.

Soil survey of the Fort Laramie area, Wyo.-Nebr., J. O. Veatch and R. W. McClure (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1917, pp. 50, fig. 1, map 1*).—This survey deals with the soils of an area of 362,240 acres situated in the Great Plains Region of eastern Wyoming and western Nebraska, including the central part of Goshen County, Wyo. Most of the area is included in a great lowland erosion plain. The principal topographic features include (1) the north Platte Valley, (2) the Goshen Hole lowland plain, (3) the Goshen Hole escarpment, and (4) the High Plains proper. There is little naturally wet or poorly drained land with the exception of a few small, low, flat areas. The soils of the area owe their most prominent characteristics to climate. A grayish color predominates, and the subsurface is much lighter in color than the top soil. There is a high relative percentage of soluble mineral salts, a concentration of lime and other salts at shallow depths, a friable and granular structure at certain depths, and a low humus content. Including rough broken land and dune sand, 25 soil types of 11 series are mapped, of which the Rosebud silt loam and very fine sandy loam cover 19.2 and 13.4 per cent of the area, respectively.

The agriculture and soils of the Cape Province, A. Stead (*Union So. Africa, Dept. Agr. Jour., 1 (1920), Nos. 2, pp. 152–158; 4, pp. 351–358; 5, pp. 429–441; 7, pp. 660–670; 9, pp. 819–828, figs. 12*).—This is a preliminary report on the origin and geology, physical, mechanical, and chemical properties, fertilizer requirements and crop adaptation of the soils of the so-called Witkop-Burghersdorp area in the Union of South Africa.

The principal classes of soils recognized are the so-called black turf, which the sand-bult, which is a sedentary, fine sandy soil retentive of moisture but infertile; and the mixed turf, which is a colluvial soil fairly rich in organic matter and lies at the lower slopes of rather steep hills. With reference to the influence of geological origin on the fertility of soils, it is shown that the best soils of the area are those in which the formation has been influenced by lava or dolerite.

The methods of sampling and analysis used are briefly described in an appendix.

The "alkali" content of soils as related to crop growth, F. T. SHUTT and E. A. SMITH (*Roy. Soc. Canada Proc. and Trans., 3. ser., 13 (1919), Sect. III, pp. 233–242, figs. 4*).—A progress report is given on the second year of studies previously described (E. S. R., 40, p. 719). Two series of studies of wheat soils and one each of western rye grass and oats soils were conducted.

The alkali in an irrigated brown loam soil of good quality growing wheat was mainly sodium sulphate. Where the growth of wheat was good the concentration of sodium sulphate was low and practically uniform. Where the growth was poor the concentration was higher, and where there was no growth the concentration of sodium sulphate was 0.9 per cent and of magnesium sulphate 0.273 per cent. The sulphates of sodium, magnesium, and calcium were found in a second wheat soil which was not irrigated but obtained moisture from seepage from a canal. Where the growth was good the concentration of sodium sulphate was 0.103 per cent in the surface 6 in. and increased with the depth. A poor growth resulted on soil containing 0.5 per cent of sodium sulphate at a depth of 3 ft.

In irrigated sandy loam soil growing rye grass sodium carbonate predominated. Where the growth was good the concentration of sodium carbonate was 0.168 in the top 6 in. of soil, but where the growth was poor the concentration was 0.227 per cent. There was no growth when the concentration reached 0.272 per cent. These results are taken to indicate that the limiting concentrations of sodium carbonate are from 0.1 to 0.15 per cent for rye grass.

Sodium carbonate was also the harmful salt in irrigated brown loam soil growing oats. There was a good growth with a concentration of this salt of 0.066 per cent, and it is concluded that approximately 0.05 per cent in the top 6 in. of soil does not markedly affect the growth of oats. Where the growth was poor the concentration of sodium carbonate was 0.243 per cent in the surface, and there was no growth where the concentration reached 0.477 per cent. The experiments are being continued.

Relation of the calcium content of some Kansas soils to the soil reaction as determined by the electrometric titration, C. O. SWANSON, W. L. LATSHAW, and E. L. TAGUE (*Jour. Agr. Research [U. S.], 20 (1921), No. 11, pp. 855–868*).—Experiments conducted at the Kansas Experiment Station, in which a number of soils from different parts of the State were analyzed for total calcium and calcium in forms soluble in N/5 hydrochloric acid and in normal hydrochloric acid are reported. The amount of carbon dioxid in these soils was also determined.

Ten-gram samples of these soils were placed in neutral distilled water, and the initial reaction was determined by means of the hydrogen electrode. Fifth-normal calcium hydroxid was added to change the reaction to a higher alkalinity. The points determined were the number of cubic centimeters of N/25 calcium hydroxid needed to bring the reaction (if lower) to P_H7, $P_H8.3$, and P_H10.

In soils of a high calcium content a larger percentage of the calcium was in forms soluble in these dilute hydrochloric acid solutions than in soils of a low calcium content. As a rule soils of a high hydroxyl-ion concentration than soils of low calcium content. The amount of N/25 calcium hydroxid required to change a soil from a lower to a higher hydroxyl-ion concentration depended more upon the amount of colloidal clay present than upon the calcium content.

Subsoils as a rule were found to have a higher calcium content than surface soils. It required more calcium hydroxid to change these subsoils from a lower to a higher hydroxyl-ion concentration than it did for the corresponding surface soils. This was true for most of the soils. The exceptions were due either to a very high calcium content in the subsoil as compared with the surface soil, to a larger amount of sand in the subsoil, or to some unusual condition of the soil and subsoil. The amount of N/25 calcium hydroxid required to change the acid soils to a reaction represented by P_H7, calculated in equivalent pounds of calcium carbonate per acre, compared favorably with some other current methods of determining the lime requirements of the soil. In some soils the amount of calcium hydroxid, calculated in equivalents of pounds of calcium carbonate per acre, required to change to a concentration represented by $P_H8.3$ was as great as the equivalent amount of acid-soluble calcium present in the soil or greater.

Soil acidity investigations (*Indiana Sta. Rpt. 1920, p. 38*).—Water culture studies on the effect of different hydrogen-ion concentrations of several acids and their aluminum salts showed that both the hydrogen and aluminum ions were toxic in varying degrees to different plants. In the case of such plants as corn and barley the toxicity of soil acidity seemed to be due more to the aluminum than the hydrogen ion.

The results of greenhouse and field plat experiments on acid peaty sand soil pointed to the same conclusion. Another phase of the experiments indicates that available phosphates aid greatly in reducing aluminum toxicity both with and without lime.

Nitrification in acid soils, R. E. STEPHENSON (*Iowa Sta. Research Bul. 58 (1920), pp. 331–349*).—Pot studies in the greenhouse with Carrington loam soil to which lime was added at rates of 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 12, 15, and 20 tons per acre and in which optimum moisture conditions were maintained are reported. The pots were sampled at intervals of 2, 2, 4, 4, 4, and 7 weeks and tests made of their nitrifying powers. Alfalfa was grown in a second series of pots receiving the same treatments except that the 6, 8, 10, and 15 ton lime applications were omitted.

It was found that nitrification occurred in the presence of a rather high lime requirement. A scarcely measurable effect was produced in the nitrification of the original soil nitrogen by the application of calcium carbonate. Lime did cause a marked increase, however, in the nitrification of ammonium sulphate.

The acid soils were never completely neutralized even with the very heavy application of lime, apparently because of the slow solubility of a part of the acidity present. The results indicate that though very large amounts of lime may give greater nitrification, only that which is necessary to neutralize the most active acids is essential for adequate nitrification.

The growth of alfalfa was at a maximum when an amount of lime approximately equivalent to the indicated requirement was added. Growth was nearly as good without any lime as with the heavier applications.

The fixation of nitrogen in Colorado soils, W. P. HEADDEN (*Colorado Sta. Bul. 258 (1921), pp. 3–48, fig. 1*).—Continuing work previously noted (E. S. R., 25, p. 814), studies of the source, quantities, and relation between the occurrence of nitrates in the soils and well waters of a new district about 14 [illegible] of Fort Collins, Colo., are reported. The study led to the recognition of a rather large area south and east of Wellington, in Larimer County, throughout which nitrates occur abundantly in the surface soil. Another smaller occurrence in the Dry Creek section south and west of Waverly was also established.

It was found that the waters of shallow wells and the surface soils are closely related in regard to their nitric nitrogen content. No abnormally large amount of nitric nitrogen was found in the soil or in shallow wells of the district outside of the niter areas. The waters from deep wells, even when sunk through or adjacent to areas very rich in nitric nitrogen, were free from it. The composition of the salts held in solution in the deep well waters differed from that of those held in the ground waters. The former held essentially sodium and calcium sulphates, while the latter held magnesium and sodium nitrates and sulphates with some calcium sulphate.

The extracts of soil samples taken from these areas were characterized by the presence of much magnesia and nitric acid and low contents of sulphuric acid, calcium, and sodium. The potash contents of such extracts were uniformly high, varying from 0.7 to 2 per cent of the total soluble portion.

It is considered evident that the ground waters derive their nitrates from the soil, and that the amount is determined by local conditions. It was also found that calcium and magnesium chlorids occur in considerable abundance in some of the soil extracts, and that the surface soil, especially at the edges of these niter areas, has a very high nitrogen-fixing capacity. The view is again expressed that within this area the nitrates are formed in situ through bacteriological agencies.

[Phosphorus combinations and soil potassium] (*Ohio Sta. Bul. 346 (1920), pp. XXII, XXIII*).—Studies on the influence of soil reaction and cultivation upon the organic phosphorus content of soil led to the conclusion that the reaction of the soil is practically without influence upon the proportion of the total phosphorus which is present in organic form. The organic phosphorus compounds of a number of soils, both acid and basic, cultivated and virgin, were apparently quite similar in nature, although there were large variations in the actual amounts present in various soils. The results showed that cultivation and cropping appreciably decrease the total and the organic phosphorus, and in practically the same ratio. It was found that an average of one-third of the total phosphorus of surface soils and one-fifth of that of subsoils is in organic combination. The amounts of organic phosphorus seemed to be closely related to the total organic matter and nitrogen content of the soils studied. The organic phosphorus did not appear to be of a high order of availability.

Studies with oats on the influence of fertilizers on the availability of rock phosphate showed that the phosphorus content of the oat plant, where rock phosphate was applied, was considerably in excess of that of the crop grown on soil not treated with rock phosphate. The most decided indication was obtained from the oats sampled eight weeks after seeding. The percentage of phosphorus at this time was more than twice that of the mature crop. The yield of the oat crop studied was increased by rock phosphate. While the addition of other fertilizers produced a further increased yield with a larger removal of phosphorus, no very definite indications that the fertilizer treatment on individual plats affected the availability of the rock phosphate were obtained.

Studies on the potassium supply of the soil showed that the effect of treatment with fertilizers and lime on the soluble potassium content is apparently due to the larger removal of potassium by crops where conditions are more favorable to crop growth, rather than to the direct action of the additions on the potassium-bearing minerals of the soil.

[Experiments on maintenance of soil fertility] (*Ohio Sta. Bul. 344 (1920), pp. 239–256, 276–287, 302–314, 332–340, 367–372, 374–384, 396–402, 419–441, 454–456, 468, 469, figs. 5*).—Data on the results of experiments at the nine county experiment farms are reported.

For the Miami County Experiment Farm R. R. Barker reports that in six rotations carried through a period of 10 years acid phosphate used at the rate of 200 lbs. per acre for each crop has added 8 bu. to the yield of corn, and the same quantity of acid phosphate reinforced with 50 lbs. of potassium chlorid has added nearly 13 bu. The same amount of acid phosphate has increased the yield of wheat from 11 to 22 bu. where the wheat has followed oats or corn, and from 11 to 27 bu. where the wheat has followed soy beans.

The results of four rotations being conducted on the Paulding County Experiment farm, reported and discussed by H. R. Hoyt, are too irregular to justify any but general conclusions, but are taken to indicate that the soil of the farm is not more deficient in one of the principal elements of fertility than in another, and that profitable increases are to be obtained only through an increase of all three of the main fertility ingredients. The slow-acting phosphates such as raw rock and bone meal seem to have given better results than acid phosphate. Lime appears to have been detrimental. "Taken as a whole, the experiment would seem to encourage the use on sugar beets of a complete fertilizer of much higher grade than any ready-mixed fertilizer ordinarily found on the market."

The results of four experiments with fertilizers, lime, and manure on crops grown in rotation on the Clermont County Experiment Farm, reported and discussed by H. W. Rogers, show that drainage, lime, phosphorus, potassium, and nitrogen are necessary on the impoverished soil of this farm. It was found that when all these ameliorants were employed, using manure as the carrier of nitrogen and phosphorus, the cost of the lime and phosphorus and nearly half that of the drainage was recovered in a single 4-year period.

Data on the results from two rotations in progress on the Hamilton County Experiment Farm, reported by Rogers, are taken to indicate that a much larger use of phosphorus and potassium is justified on Hamilton County crops and that manure and clover should be depended upon as the chief sources of nitrogen.

Soil-fertility studies, by C. E. Thorne, with field crops on the Washington County Experiment Farm, indicate the importance of careful saving and moderate use of manure, supplemented by acid phosphate and powdered limestone on land that can not be reached with the manure. Data on the use of fertilizers and manure on truck crops are reported by Thorne, no conclusions being drawn.

Data on the use of fertilizers and soil amendments on a 4-year rotation of corn, oats, wheat, and clover being conducted on the Trumbull County Experiment Farm, and on the use of fertilizers and manure on three crop rotations and on truck crops on the Mahoning County Experiment Farm, are reported and discussed by J. P. Markley, no conclusions being drawn.

Data on the use of fertilizers in a 5-year rotation at the Belmont County Experiment Farm, reported by C. W. Montgomery, are taken to indicate that phosphorus and lime are the most important constituents of a fertilizer for this soil.

The progress results of two experiments with fertilizers and manure on a 4-year rotation on the Madison County Experiment Farm are reported and discussed by Thorne, no conclusions being drawn.

Comparison of peanut meal, cottonseed meal, velvet bean meal, ammonium sulphate, and nitrate of soda as fertilizers for corn and cotton, E. F. Cauthen (*Alabama Col. Sta. Bul. 215 (1921), pp. 3–8*).—This is substantially a reprint of the results reported in Bulletin 208 of the station (E. S. R., 43, p. 135), to which has been added the result of the 1920 test on cotton. These results give average efficiencies for both crops of 80 for cottonseed meal, 87 for peanut meal, and 54 for velvet bean meal, as compared with sodium nitrate.

Manufacture of synthetic ammonia at Oppau, Germany, I–III (*Tech. Moderne, 1920, Nov., pp. 449–460; also in Chem. and Metall. Engin., 24 (1921), Nos. 7, pp. 305–308; 8, pp. 347–350; 9, pp. 391–394, figs. 22*).—The processes and apparatus used at this plant in the manufacture of synthetic ammonia and other nitrogenous compounds for use as fertilizers are described.

In this process water gas is mixed with producer gas in convenient proportions, steam is added to the mixture, and the whole is passed over a catalyzer at a temperature between 400 and 500° C. The carbon monoxid and steam react, producing hydrogen and carbon dioxid. The carbon dioxid is dissolved in water under pressure and the remaining gaseous mixture is freed from harmful traces of carbon dioxid and carbon monoxid by passing it through solutions of caustic soda and ammoniacal copper formate.

The resulting gaseous mixture contains about 3 volumes of hydrogen per volume of nitrogen. It is subjected under pressure of 200 kg. and at a temperature of about 500° to the action of a second catalyzer, producing a little ammonia, which is immediately absorbed by water. Fresh amounts of gases are added to the remaining gases, which do not combine during this operation, and the whole is passed again through the catalyzer.

The ammonia obtained by the distillation of the solution may then be oxidized by catalysis, combined with nitric acid thus formed to give ammonium nitrate, used for the production of ammonium chlorid by the Solvay process or used for the production of ammonium sulphate by reaction with gypsum in the presence of carbon dioxid.

At this plant different fertilizers are manufactured, such as ammonium nitrate, ammonium potassium nitrate, and a mixture of ammonium nitrate and potassium chlorid.

I, Potash shales of Illinois. II, Geology, distribution, and occurrence in Union County. III, Finely ground shale as a source of potassium for soil improvement, S. W. Parr, M. M. Austin, F. Krey, and R. Stewart (*Illinois Sta. Bul. 232 (1921), pp. 225–252, figs. 7*).—This bulletin consists of three parts and was prepared jointly by the University of Illinois, the Illinois Geological Survey, and the Illinois Experiment Station.

Part 1 presents a brief account of studies of the potash-bearing qualities of certain Illinois oil shales. It was found that shales occur in at least two localities in the State which contain 5 per cent or more of potash. It is noted that shale outcropping near Jonesboro, in Union County, which contains 5 per cent of potash, would be suitable for use in the manufacture of Portland cement. By applying the known methods of potash recovery in cement manufacture, it is estimated that a yield of 5.3 lbs. of potash, valued at from 70 to 80 cts. per barrel of cement, could be obtained. The southern Illinois shale contains free oil, bituminous matter, pyrite, undecomposed potassium-bearing feldspathic rock, and potassium-bearing material of the nature of glauconite. Shale from Dixon, Lee Co., contains 5.8 per cent of potash, which is held for the most part in a more stable condition than that in the southern Illinois shale. Extraction of the potassium from shale of either the southern Illinois or the Dixon type by means of solid or liquid reagents would seem to be impracticable because of the cost of leaching and recovering potash from material where it is present in such small amounts. The plant availability of the potash in the southern Illinois shale is probably characteristic of all the material of this type outcropping in that locality. That part of the potassium in the southern Illinois shale which is soluble in sulphuric acid is shown to be in a combination of the glauconite type. In southern Illinois shale having a potash content of 5 per cent in the raw condition or 5.6 per cent when ignited, 62 per cent of the total potash is glauconitic in character and is available as plant food.

Part 2 gives data on the geology, location, occurrence, and distribution of the potash-bearing shales of Union County.

Part 3 reports preliminary studies on the availability of finely ground shale as a source of potassium for soil improvement. These included a series of greenhouse pot cultures with wheat, oats, clover, corn, rape, and buckwheat, using peaty soil treated with finely ground leucite, kainit, alunite, and ignited alunite. It was found that the potassium in the shale can be used directly by crops in pot cultures under greenhouse conditions, and the results are considered to warrant more extended investigations, particularly in the field.

American potash equal to German potash salts as fertilizer (*Indiana Sta. Rpt. 1920, p. 36*).—It has been found that most American potash salts are equally as good for fertilizer as German potash salts. A borax test showed that even small amounts of borax in fertilizers drilled in the row with corn injured the crop. On the other hand, 16 lbs. of anhydrous borax per acre in broadcast fertilizer did no appreciable harm.

The American potash industry and its problems, J. E. Teeple (*Jour. Indus. and Engin. Chem., 13 (1921), No. 3, pp. 249–252*).—A description of the problems encountered in the production of Searles Lake potash is given, together with the methods arrived at in their solution.

Bat guano and its fertilizing value, W. A. Albrecht (*Missouri Sta. Bul. 180 (1921), pp. 15, figs. 7*).—A brief study of bat guano and tests of its fertilizing value are reported, special attention being paid to guano from caves in Missouri.

Analysis of guano from Missouri caves showed that the nitrogen content varies from 0.31 to 10.44 per cent, phosphoric acid from 2.5 to 7.9 per cent, and the potash from 0.36 to 1.9 per cent. Its moisture content is usually high, often approaching 50 per cent.

Ammonification tests showed that the fresher bat guano produced ammonia in amounts equal to that of tankage. Even greater amounts of nitrates were produced. Guano was not the equal of dried blood in ammonia and nitrate production.

Pot culture experiments with oats showed that bat guano gave results superior to those given by dried blood, tankage, and ammonium sulphate. Guano also gave better results than ammonium sulphate in field experiments with oats. Brief recommendations for the use of guano are given.

The influence of marine fertilizers on the shores of the Gulf of Morbihan, A. Choveaux (*Ann. Géogr., 29 (1920), No. 162, pp. 417–425, fig. 1*).—A brief description is given of the use of natural fertilizers of marine origin, including marls, marine algae, and organic and mineral mixtures, by the inhabitants of the islands in the Gulf of Morbihan in western France.

Fertilizer production and natural fertilizers in the Union, C. F. Juritz (*So. African Jour. Indus., 3 (1920), Nos. 6, pp. 495–509; 7, pp. 618–626*).—The results of a survey and investigation of some of the waste and raw materials in the Union of South Africa, capable of conversion into fertilizers, are reported.

The materials investigated included abbatoir offal, refuse from fisheries, tanneries, military camps, and hospitals, mining compounds, bones, and rock phosphates, various plant products, and sugar-factory waste. In conclusion, it is stated that of all the sources of fertilizers in the Union, none is fundamentally more important than those which can supply soil and plant with phosphatic material. It is pointed out, however, that phosphate rock can not benefit the growing crop to any appreciable extent until several years after application.

One of the chief potential sources of potash in South Africa is said to be the wool industry. Potash in the carbonate form is present in Karroo ash and in plant ashes generally, but can not be safely used on soils having a tendency to become alkaline.

Inspection of commercial fertilizers for 1920, H. R. Kraybill, T. O. Smith, and C. P. Spaeth (*New Hampshire Sta. Bul. 196* (*1920*), *pp. 15*).—This bulletin contains the results of actual and guarantied analyses of samples of 100 brands of fertilizers and fertilizer materials collected for inspection in New Hampshire during 1920. Of the samples analyzed, 22 per cent showed a deficiency of 0.2 per cent or more in one or more of the main plant nutrients.

AGRICULTURAL BOTANY.

Sturtevant's notes on edible plants, edited by U. P. Hedrick (*New York State Sta. Rpt. 1919, pt. 2, pp. VII+686, pl. 1*).—Descriptive notes are given of nearly 3,000 species of edible plants in which their original habitats, geographical distribution, variation under cultivation, and uses are indicated. The arrangement is alphabetical by genera and species, and for many, common English and vernacular names are given. The book is based on voluminous manuscripts and notes that have been in possession of the station since 1887, when Dr. Sturtevant ceased to be director.

The North American species of Pennisetum, A. Chase (*U. S. Natl. Mus., Contrib. U. S. Natl. Herbarium, 22* (*1921*), *pt. 4, pp. X+209–234, figs. 14*).—A revision is given of 14 species of Pennisetum which occur in North America, only one of which is indigenous in the southern United States.

The progress of mendelism, W. Bateson (*Nature* [*London*], *104* (*1919*), *No. 2610, pp. 214–216*).—In a review of recent research and discussion, it is pointed out that much of the new work on genetics is in the incipient stage and that much wider tests than those yet made are needed. Among the objects of attack the most important is the question at what point of time segregation occurs. In examples cited, segregation is supposed not to antedate the constitution of the sexual organs. Particulars cited emphasize the suggestion that, considered as genetic mechanisms, plants may be fundamentally distinct from animals, which suggestion is already presented by the contrast between their modes of growth.

Though sex behaves in so many ways as a Mendelian allelomorph, showing frequent phenomena of linkage, it is considered remarkable that no case of crossing over in respect of these linkages has yet been established. Many complex cases of interaction between factors have been successfully analyzed. The balance of evidence perhaps suggests that many factors can, and on occasion do, break up (as a sex factor almost certainly does), some commonly, others exceptionally, while others, again, seem to maintain their individuality unimpaired indefinitely. As bearing on evolutionary theory, the new work leaves us still without any uncontrovertible example of coderivatives from a single ancestral origin producing sterile offspring when intercrossed.

The present position of the mutation theory, H. de Vries (*Nature* [*London*], *104* (*1919*), *No. 2610, pp. 213, 214*).—This is a synthetic review dealing with views and tendencies with regard to the appearance, propagation, and establishment of new characters in both animals and plants.

Since the publication of the author's book on the mutation theory, numerous instances of mutation have been observed in both animals and plants. It is now generally conceded by mutationists that the initial change takes place in the production of the sexual cells before fecundation. From this conception it follows that the chance of two similarly mutated cells to meet one another in this process must be very small, whereas ordinarily the mutated cells will combine with normal ones. This must produce half mutants, and these may, in ordinary cases at least, split off the full mutants after the same rules which Mendel discovered for his hybrids. Sometimes the half mutants will be distinct from their ancestors, as in *Œnothera lamarckiana rubrinervis* and *erythrina*, and, therefore, will easily be discovered. In other instances external differences may be absent, and only the unexpected production of a new type in about 20 to 25 per cent or more of the individuals will betray the internal change. This explains the mass mutations discovered by Bartlett. Such an indirect way of producing mutations by means of two successive steps seems to be very common in nature, and will probably afterwards prove to be the general rule. The broad arguments for the mutation theory are continually increasing in number, whereas the criticisms are more and more directed against special cases. They are concerned with the possibility of experimental proof and with the fitness of the material for further studies, but are not expected to invalidate the theory as such.

Plant distribution around salt marshes in relation to soil acidity, E. T. Wherry (*Ecology, 1 (1920), No. 1, pp. 42–48*).—As a result of determinations of soil acidity and alkalinity made upon plants growing under the widest possible range of physical and climatic conditions, the author has found abundant evidence that the acidity of the soil is closely connected with the distribution of native plants. An account of a few observations is presented here to illustrate the possibilities of this method in throwing light on the significance of peculiar types of plant distribution. The measurement of the actual soil acidities and alkalinities connected with certain species of plants, which is all that is attempted here, is deemed but one step in the working out of the problem of why a given plant grows in a certain place, but the results presented are intended to show the considerable, if not fundamental, importance of this often neglected step.

Floral and extrafloral nectaries, H. Böhmker (*Bot. Centbl., Beihefte, 33 (1917), 1. Abt., No. 2–3, pp. 169–247*).—This is a detailed account of nectaries in a large number of monocotyledons and dicotyledons, with bibliography and summation of facts regarding anatomy and physiology and products or contents of nectaries.

Vivipary in grasses, W. Kinzel (*Ztschr. Pflanzenkrank., 26 (1916), No. 5, pp. 285–291*).—This is an account with brief discussion of work left unfinished in 1915 on viviparousness in grasses and its relation to other disturbances of normal seed development.

Seasonal changes in the chemical composition of apple spurs, H. D. Hooker, jr. (*Missouri Sta. Research Bul. 40 (1920), pp. 3–51, figs. 28*).—The author reports on investigations of apple spurs, with leaves, flowers, or fruit removed, collected at six different times during the year, their chemical composition being studied in relation to their physiological condition. Three types of spurs were investigated, those that blossomed and bore fruit; spurs that did not blossom, but which developed fruit buds; and barren spurs that neither blossomed nor developed fruit buds. Determinations were made of the dry weight, ash, titratable acidity, potassium, phosphorus, total nitrogen, reducing and nonreducing sugars, starch, total polysaccharids, and hydrogen-ion concentration.

It was found that the seasonal changes in most of the constituents examined were distinct and characteristic of the condition of the spur as to its bearing, nonbearing, or barren quality. In general, the bearing and sterile spurs showed extreme values, while the nonbearing spurs assumed an intermediate position.

The conditions characteristic of the bearing and nonbearing spurs of the same tree were found to be practically identical with the conditions of spurs from different trees in bearing and in the off year, respectively. Spurs from barren trees were characteristically distinct from the two types of spurs from productive trees. For most constituents the spurs were found to pass through one period of maximum content and one of minimum content during the course of the year. In the case of starch and titratable acidity there were found two maxima and two minima, the maxima of one coming at practically the same time as the minima of the other. Carbohydrate consumption and acidity were found to be correlated.

Conditions leading to high starch and low nitrogen content at the time of fruit-bud differentiation were found essential for productivity. Fruit-bearing spurs that developed leaf buds had a low starch and a high nitrogen content, and barren spurs a low starch and low nitrogen content. The starch-nitrogen ratio is considered more indicative than the total carbohydrate ratio.

There was found during the late summer and fall a steady increase in the phosphorus and nitrogen content of spurs with fruit buds. The absence of this feature in barren spurs is said to suggest a necessity for phosphorus and nitrogen storage, making possible the marked increase in these elements that is peculiar to bearing spurs in the spring.

Growth and sap concentration, H. S. Reed (*Jour. Agr. Research* [*U. S.*], *21* (*1921*), *No. 1, pp. 81–98, figs. 7*).—In a contribution from the Citrus Experiment Station, Riverside, Calif., the author gives an account of investigations on the comparative concentration of sap as related to the growth rate of young walnut, apricot, and orange trees. The growth and sap concentration of young trees was found to vary in opposite directions; that is, rapid growth was associated with a generally lower concentration of sap in the shoot, while slower growth was accompanied by higher concentration of sap. There was found to be a gradual increase in sap concentration as the season advanced. In apricot trees the concentration continued to increase for some time after active growth had ceased.

Of several environmental factors measured, soil moisture was the only one found to have an obvious effect upon sap concentration. The addition of water to the soil usually diminished the concentration of the plant sap. The sap concentration of shoots on heavily pruned trees was lower than that of shoots on trees not pruned, because of the more rapid growth of the former.

A greater concentration of sap was found in the apical portion of the stems than in the basal regions, and the concentration of sap in stems showed a greater tendency to fluctuate than that in the leaves. Generally, lower concentrations of sap in the shoot appeared to be associated with abundant water intake and rapid vegetative growth. Higher concentrations were associated with slow growth and fruit-bud formation.

The results of this investigation are said to indicate that the practice of summer pruning fruit trees is not only unnecessary but may be detrimental.

The magnitudes and variations of osmotic values, G. Blum (*Bot. Centbl., Beihefte, 33* (*1917*), *1. Abt., No. 2–3, pp. 339–445*).—Extensive data are detailed with discussion as obtained from a study of osmotic behavior in *Helleborus foetidus*, *Urtica dioica*, *Fagus silvatica*, *Sedum acre*, and *Funaria hygrometrica*,

Comparative utilization of the mineral constituents in the cotyledons of bean seedlings grown in soil and in distilled water, G. D. Buckner (*Jour. Agr. Research [U. S.], 20 (1921), No. 11, pp. 875–880*).—In a contribution from the Kentucky Experiment Station the author describes an experiment undertaken with a view to comparing the degree of utilization of the total ash and the elements calcium, magnesium, and phosphorus in the cotyledons of bean seedlings grown in distilled water and in garden soil. This investigation was in continuation of work previously noted (E. S. R., 34, p. 427). It was found that when beans were grown in soil a notably larger amount of reserve material was translocated from the cotyledons than when they were grown in distilled water. In both cases a smaller proportion of calcium was translocated than of phosphorus or magnesium.

Heat production by germinating seed, E. Leick (*Bot. Centbl., Beihefte, 33 (1917), 1. Abt., No. 2–3, pp. 309–338*).—Data are given in tabular form regarding the heat developed during the germination of different seeds.

A study of the photosynthesis of sugar cane, G. G. Yap (*Philippine Agr., 8 (1920), No. 8–9, pp. 269–276*).—This work deals principally with the amount of carbon dioxid which the leaf absorbs from the air during photosynthesis. The method employed is that involving the measurement of the amount of carbon dioxid absorbed by the leaf. The results of the studies are tabulated with discussion.

It was found that the rate of photosynthesis decreases from 10 a. m. to 4 p. m., with maximum activity from 8 to 10 a. m. Very young leaves were found to be most active, the activity decreasing with age. The rate of respiration appeared to be less than one-half that of photosynthesis. High light intensity probably had an indirect relation to the rate of photosynthesis, tending to decrease this activity. The rolling of the tips of the leaves appeared to be associated with the decrease in the rate of photosynthesis.

Carbon monoxid a respiration product of Nereocystis luetkeana, S. C. Langdon and W. R. Gailey (*Bot. Gaz., 70 (1920), No. 3, pp. 230–239, figs. 3*).—The work here dealt with at greater length than in a recent note (E. S. R., 44, p. 28) is said to have confirmed the conclusions of Langdon, as previously noted (E. S. R., 26, p. 804), regarding the existence of a percentage of carbon monoxid in the gas contained in the pneumatocyst of the Pacific Coast kelp *N. luetkeana.*

The substance of the kelp when ground and permitted to undergo autolysis and decay does not form carbon monoxid by enzym action or fermentation process, although living plants, in which the gas normally present within the floater is replaced by air, form several per cent of carbon monoxid within a few days. Gas obtained from the cavities of various other plants failed to show a similar occurrence of free carbon monoxid.

Gas injury to plants, P. Sorauer (*Ztschr. Pflanzenkrank., 26 (1916), No. 3–4, pp. 129–183, pl. 1, figs. 5*).—Flowers after opening were checked by contact with illuminating gas and often altered as to coloration. Unopened flowers seldom developed further. Leaves fell or wilted with yellowing and drying from the tip or edge inward, or spotting. More axial portions of the plants showed a considerable variety of changes, some of which are detailed as are those in the roots.

The study here noted leads to the general conclusion that the consequences of poisoning by illuminating gas are symptoms indicating suffocation from lack of oxygen and accumulation of water in the lower axis with deprivation of water in the higher portions.

FIELD CROPS.

[Report of field crops work at Holly Springs, Miss., Substation, 1915–1920], C. T. AMES (*Mississippi Sta. Bul. 193 (1920), pp. 1, 4–21, figs. 2*).—Variety tests of cotton on hill and valley land, corn, and sweet potatoes; cotton spacing experiments; fertilizer trials with cotton, corn, and legumes; and lime tests with corn, oats and vetch, and cowpeas, conducted during the period 1915–1920 are described; and information presented on the culture of Bermuda grass pasture, sweet potatoes, crimson clover, bur clover, velvet beans, and alfalfa. Earlier work with field crops at this station has been noted (E. S. R., 32, p. 526).

The results of cotton variety tests during the period commend Cleveland strains, Wannamaker-Cleveland, Miller, Cleveland Big Boll, and Triumph for hill land, and Wannamaker-Cleveland, strains of Trice and Express, Webber 49, and Sunflower for valley land. The average results of five years' spacing tests indicate that, on land which with the addition of fertilizer will average three-quarters of a bale per acre, cotton should be planted in 3.5-ft. rows and thinned to 10 or 12 in. On less productive land, 3-ft. rows and closer spacing are suggested. From the tabulated results of 13 years' fertilizer tests with cotton, it is concluded that the use of both nitrogen and phosphorus are beneficial, with applications of 200 lbs. of cottonseed meal and 200 lbs. of acid phosphate per acre giving the best results.

Work with corn has been noted from another source (E. S. R., 45, p. 37).

Triumph, Porto Rican Yam, and Nancy Hall, with four-year average acre yields of 294, 281, and 240 bu., respectively, headed the sweet potato varieties.

[Field crops work on county experiment farms in Ohio in 1918 and 1919], C. W. MONTGOMERY ET AL. (*Ohio Sta. Bul. 344 (1920), pp. 237, 238, 256–258, 270, 271, 273, 274, 287–289, 298, 299, 314–317, 327, 328, 341–343, 355–357, 373, 374, 395, 403–406, 441–443, 457, 458, 470, 471, 475, 477, 478, fig. 1*).—The continuation of work with field crops on experiment farms located in Miami, Paulding, Clermont, Hamilton, Washington, Trumbull, Mahoning, Belmont, and Madison Counties is reported along the same general lines as noted heretofore (E. S. R., 39, p. 737). The experiments comprised rotation tests, including corn, oats, wheat, clover, soy beans, sugar beets, potatoes, and tobacco; fertilizer, manuring, and liming tests with the crops in the rotations; fertilizer tests on pasture; variety trials with corn, oats, wheat, and soy beans; date and rate of seeding tests with wheat; and a comparison of drilling soy beans solid and in rows. The data obtained are tabulated and discussed in separate reports for each county. Summarized results of all the fertilizer experiments and variety tests are tabulated. The varieties of the different crops outstanding in the tests have been noted previously.

[Report of field crops work in the Virgin Islands, 1920], L. SMITH (*Virgin Islands Sta. Rpt. 1920, pp. 7–17, 18, 19, pls. 2, fig. 1*).—The continuation of work similar to that noted heretofore (E. S. R., 44, p. 332) is reported for the year 1920.

Work with sugar cane included breeding experiments and trials of seedlings and varieties. The average increases given by the best St. Croix varieties over Ribbon, the standard, were as follows: S. C. 12/37, 8.4 tons of cane and 2,303 lbs. of sucrose; S. C. 12/4, 3.4 tons of cane and 1,197 lbs. of sucrose; and S. C. 14/93, 5.4 tons of cane and 1,365 lbs. of sucrose. Other seedlings outstanding included S. C. 13/13, B. 3412, B. 16536, B. 4596, B. 6388, and B. H. 10/12.

Only 180 acres of cotton were planted on the island of St. Croix in 1920 and the yields averaged only about 600 lbs. of seed cotton per acre. The lint of St. Croix Sea Island cotton brought from $1.80 to $2 per lb. in the Liverpool markets. The largest yield obtained in plat tests was at the rate of 4,450 lbs of seed cotton per acre, individual plants giving over 2 lbs. of seed cotton each. The lint length of this variety was 1¼ in.

Corn experiments on ear-to-row improvement and hybridization are briefly noted.

Sweet potatoes manured at the rate of 20 tons per acre produced only one-half the yield of those grown on unmanured plats.

In tests of legumes for various purposes, velvet and Lyon beans were best for green-manuring purposes, Black Venezuelan for seed, and Longfellow Six Weeks and Madagascar for string beans. Notes on Napier grass, Guatemala grass, and castor bean selections are also given.

Pasture plants and pastures of New Zealand, F. W. Hilgendorf (*Auckland and London: Whitcombe & Tombs, Ltd., 1918, pp. 96, figs. 36*).—A practical handbook, designed for farmers and students of New Zealand, comprising descriptions of the botanical and agricultural characters of common pasture grasses, weed grasses, native grasses, clovers, and other pasture plants, with artificial keys for the identification of grasses and cloverlike plants. Pasture management and improvement are treated at some length, and grass mixtures are suggested for various purposes and soil types.

Lodging of small grain (*Ohio Sta. Bul. 346 (1920), pp. XX, XXI*).—Moisture determinations made on the stems of plants grown in the greenhouse indicated that the points just above the nodes are the weak spots. However, determinations of breaking strength made on plants soon after the first appearance of the heads, while the stems and leaves were both green, showed that at that stage of growth the breaking of the stem occurs almost always below the nodes, indicating that even though the weak points in the culms are immediately above the nodes, the support offered by the green leaf sheath is such as to render that part of the stem stronger than the part just below the nodes. As the plants approach maturity and the leaves begin to dry and the sheath begins to loosen its hold around the stem, the stems then almost invariably break above the nodes.

Investigations of spontaneous combustion of hay, G. Lauppek (*Landw. Jahrb. Schweiz, 34 (1920), No. 1, pp. 1–54, figs. 5; abs. in Jour. Min. Agr. [London], 27 (1921), No. 12, pp. 1163, 1164*).—The author presents an exhaustive account of earlier work and current investigations concerning the firing of haystacks and discusses in detail the chemical reactions involved in spontaneous combustion. From the results of recent researches, the probable causes of firing of haystacks may be stated as follows:

Four successive phases may be distinguished in the heating of haystacks. In the first phase, the hay sweats and generally reaches a temperature of 50° C. (122° F.) within two days. The second phase is characterized by increased sweating, and much vapor, accompanied by an aromatic odor, is given off. The hay turns light brown in color and reaches a temperature of 70° in about a week. In the third stage the temperature rises to 90°, being accompanied by much vapor and a pungent odor, and resulting in a dark brown hay. The duration of this phase may run from two to three weeks. The fourth phase, a very dangerous period, culminates in combustion. The temperature from 90° to ignition may be reached in two hours. The phase consists of a damp distillation followed by dry distillation, gases are exhaled, a pungent and slightly burning odor may be detected, and the hay rapidly carbonizes. Hay reaching this phase without eventually firing has a black-brown or black color, and has lost most of its nutritive value.

The first and second phases are considered desirable in hay making. The heating in the first phase is due to the respiratory activity of the plant cells, while that in the second phase is variously attributed to bacterial action, ferment activity, and the catalytic action of combinations of iron and manganese. Further research appears to be necessary to determine the exact cause of this heating, with the view of preventing the onset of the third and fourth phases. The rise of temperature in these latter phases is the result of causes entirely chemical in origin.

Heating in the stack is most liable to occur with young grasses containing a large proportion of water-soluble material. Likewise in heating, the losses fall on the water-soluble material, that part of the hay of the best feeding value.

Particular points to be derived from the researches are as follows: The better the quality of forage used the more care will be required in curing the hay and building the stack in order to avoid excessive heating. The heating of the stack is dependent on the amount of water-soluble material present as well as on the presence of moisture. Rain-washed hay, even when obtained under unfavorable conditions, rarely overheats in the stack. The chief aim should be to cure the hay at the lowest possible temperature to avoid loss of nutritive value in the resulting product. The temperature of the stack will indicate the possibility of overheating and the need of precautionary measures. The warning point is 70°, and a temperature of 90° marks the critical point and indicates immediate precautionary measures. A temperature of 110° indicates the explosive point; opening of the stack at this stage will probably lead to immediate firing. Where the hay has been obtained in good condition the principal aim in stack building and in the prevention of overheating should be consolidation and not ventilation.

Handbook of legume culture, C. Fruwirth (*Handbuch des Hülsenfrüchterbaues. Berlin: Paul Parey, 1921, 3. ed., rev. and enl., pp. VIII+231, figs. 75*).—A revised edition of a work noted previously (E. S. R., 32, p. 432).

Effect of time of irrigation on kernel development of barley, H. V. Harlan and S. Anthony (*Jour. Agr. Research* [*U. S.*], *21* (*1921*), *No. 1, pp. 29–45, figs. 20*).—Studies of the effect of time of irrigation on kernel development of barley, made cooperatively at the Aberdeen, Idaho, Substation, by the Office of Cereal Investigations, of the U. S. Department of Agriculture, and the Idaho Experiment Station, are reported, supplementing other work on the kernel development of barley at this substation, noted (E. S. R., 43, p. 826). The average length, lateral and dorsoventral diameters, and percentage and weight per kernel of dry matter, water, nitrogen, and ash in kernels of Hannchen barley sampled at 24-hour intervals from eight plats variously irrigated are included in tabular and graphic form and discussed.

Deposit of dry matter in the kernel continued until very near the point of absolute ripeness. The plants were able to utilize water up to the date of full maturity. Late irrigation resulted in a greater activity and a later maturity. Deficiency of water, even after the spikes were losing their color, resulted in a checking of the deposit of dry matter. "A deficiency of water earlier in the development of the kernel probably determines the size of the kernel, even before the rate of deposit of dry matter is checked."

Corn experiments, H. B. Brown (*Mississippi Sta. Bul. 197* (*1921*), *pp. 3–20, figs. 3*).—The present bulletin presents data secured in corn experiments at the College Station since 1915 along the same lines as and supplementing work noted previously (E. S. R., 33, p. 34). Cultural practices for the eastern and central parts of the State are recommended, together with notes on corn breeding.

Vardaman, Jones Prolific, Tennessee Red Cob, and Cockes Prolific ranked highest in variety tests during five or more years. Selections of Paymaster, Tennessee Red Cob, and Mosby were outstanding in 1919 and 1920 tests, while early northern varieties, such as Johnson County White and Champion Early White, produced much damaged and rotten corn and ranked low in yield. The planting of early varieties is discouraged by the station. Large, vigorous-growing varieties, such as Tennessee Red Cob or Cockes Prolific, appeared to do best on infertile hill land. Laguna, Mexican June, Cockes Prolific, and Goliad are recommended for late planting.

Results of eight years' work with about 25 varieties in different combinations of hybrids showed that although the hybrid seed usually produced plants yielding better than those from either parent, the gain did not pay for the extra cost of producing the hybrid seed. Selfed corn exhibited marked reduction in vigor the first generation after selfing, and as a rule yielded less than one-half as much as the original open-pollinated strain. Varieties sustaining inbreeding best were usually those yielding well in other tests.

In tests of nitrogenous fertilizers in 1919, corn receiving cyanamid and ammonium nitrate averaged 38.9 and 44.1 bu. per acre, respectively, as compared with 33.3 bu. from the unfertilized check. In 1920, 100-lb. applications of cyanamid, ammonium nitrate, and nitrate of soda made average gains of 9.3, 14.2, and 10.6 bu. per acre, respectively, over the check, and 200-lb. applications of the same fertilizers made gains of 6.9, 14.4, and 15.2 bu., respectively. Treatment of 20 varieties with 200 lbs. of nitrate of soda returned an average yield of 55.8 bu. per acre, as compared with 45.7 bu. from the untreated plats, a net gain of $2 per acre from the use of the fertilizer being recorded.

Corn variety tests, 1913–1920, [at] Delta [Miss.] Branch Station, W. E. AYRES (*Mississippi Sta. Bul. 198 (1921), pp. 3–7*).—From the results of tests conducted from 1913 to 1920, inclusive, at the Delta Substation, Ewing Mosby, Woodruff Mosby, Cockes Prolific, Hastings Prolific, and Vardaman are considered the best corn varieties for delta conditions. Cockes Prolific led in 1918 and in 1920 tests planted May 28, while Ewing Mosby was first in 1919 and in the 1920 tests planted July 2.

Corn in Missouri.—I, Corn varieties and their improvement, L. J. STADLER and C. A. HELM (*Missouri Sta. Bul. 181 (1921), pp. 3–50, figs. 7*).—Results of variety tests of corn for the period 1905 to 1920, inclusive, are reported, supplementing those recorded in Bulletin 143 (E. S. R., 36, p. 135). Yields of the several varieties for periods of years at the station, outlying fields, and in cooperative tests are tabulated and discussed for the several soil types of the State. Of the various methods of corn improvement, continuous selection of seed corn in the field is recommended as most practicable for the farmer. Germination tests are advised for the detection of disease even when the germinability of the seed is unquestioned.

The best varieties for the several important agricultural sections of the State are listed as follows: Northern upland soils, Reid Yellow Dent and Leaming; central upland soils, Boone County White, St. Charles White, and Commercial White; southern upland, Commercial White; southeast lowlands, St. Charles White; and north and south bottom lands, Boone County White. In tests of corn for silage purposes at Columbia, Commercial White, St. Charles White, St. Charles Yellow, and Cartner were respectively outstanding in order of maturity.

Shrinkage determinations for various periods in the several sections of the State indicate that in northern and central Missouri the shrinkage varies considerably, while in the southern section of the State it is slight in degree and varies but little with the variety.

Cotton growing in south Mississippi, E. B. FERRIS (*Mississippi Sta. Bul. 196 (1920), pp. 3–8*).—Information concerning varieties, cultural practices, and fertilizers considered best in the production of cotton in southern Mississippi is presented, together with tabulated results of variety tests at Poplarville from 1918 to 1920, inclusive, and fertilizer tests at Poplarville and McNeill.

Trice cotton appears to be the best under average conditions. From results of fertilizer tests at both substations, it is held that the use of raw phosphate and soft phosphate rock did not pay. Although basic slag was more available than these two forms, it was behind acid phosphate in this respect, which in moderate amounts with rather small quantities of nitrogen is considered the most desirable treatment.

Cultural experiments with cotton, G. B. WALKER and W. E. AYRES (*Mississippi Sta. Circ. 35 (1921), pp. [4]*).—Results of spacing tests conducted at the Delta Substation are presented with information regarding the culture of cotton under delta conditions. In 1919 and 1920 tests, where cotton was thinned from 8 to 28 in. in the row, 8-in. spacing made the highest yields practicable with an average increase of 471 lbs. of seed cotton worth $54 per acre over 28-in. spacing. The yield decreased consistently with the decrease of stand. In all plats where the plants were more than 8 in. apart, plats with two plants per hill yielded more than those with only one plant. In summarizing the results of spacing work at other stations, it is noted that 12-in. spacing gave the best results in every series of tests.

A table of factors, by which the number of bolls on 30 ft. of row may be multiplied to obtain the number of pounds of lint per acre, has been noted from another source (E. S. R., 44, p. 435).

Report of cotton experiments at the Holly Springs Branch Experiment Station, 1919 and 1920, C. T. AMES (*Mississippi Sta. Bul. 192 (1920), pp. 3-10*).—Results of variety studies on hill and valley land, fertilizer trials, spacing tests, and weather records secured during the years noted are presented, together with suggestions for cotton culture on the brown loam soils. Conclusions based on the foregoing are embraced in the material noted on page 126.

Cotton experiments, 1919 and 1920, H. B. BROWN and C. B. ANDERS (*Mississippi Sta. Bul. 187 (1920), pp. 32, figs. 4*).—The continuation of cotton experiments at the station along the same general lines as noted heretofore (E. S. R., 42, p. 232) is described for the years indicated. Unfavorable weather in the summer of 1919 and the spring of 1920 hindered cotton production, and much boll weevil damage was reported throughout the State during both years. Cultural methods for eastern and central Mississippi and the results of tests of calcium arsenate as a boll weevil poison are outlined briefly. Statistics of the cotton acreage and production in the counties of the State in 1918, 1919, and 1920 are appended.

Cleveland and Miller are recommended for thin hill land; Trice for rich hill land, wilt-free; Express, Trice, and Foster for delta and valley land, wilt-free, but with heavy weevil infestation; Cleveland, Express, and Columbia for valley land with light wilt infection and light weevil infestation; and Tri-Cook and Lewis 63 for heavy wilt infection but few or no weevils.

In preliminary studies of oil content, a variation of more than 12 gal. of oil per ton of seed in 25 strains grown on the same plat was noted. With but few exceptions, the oil content increased as did the length of staple, indicating positive correlation, while it decreased with an increase of lint percentage, an increase of size of seed, and an increase of nitrogen (ammonia) content, indicating negative correlations.

Varieties of cotton 1919 and 1920, and summary of 10 years' results, 1911-1920, [at] Delta Branch Station, W. E. AYRES (*Mississippi Sta. Circ. 36 (1921), pp. [4], fig. 1*).—Data in this publication show Express to lead in 10-year average yields with an acre value of seed and lint of $140.72. Foster and Wannamaker-Cleveland followed closely, and Cleveland Big Boll, Miller, and Triumph were the poorest producers. Earlier work has been noted previously (E. S. R., 42, p. 232).

In 1919 experiments, selections of Cook, Trice, Foster, and Express were first in lint production. The early varieties ranked high in yields, while early long-staple cottons led in money value. The average value of the seed and lint of the three leading varieties was $298.84 per acre, while that of the three poorest was but $132.35. In 1920, Foster, Cleveland, and Cook selections and Wannamaker-Cleveland were outstanding.

A native legume forage for warm and hot climates (Desmodium leiocarpum), C. D. Girola (*Bol. Min. Agr. [Argentina], 25 (1920), No. 3, pp. 375–387, fig. 1*).—The author describes the plant and its adaptation, indicates cultural methods, and includes comparative analyses and data regarding the feeding value of *D. leiocarpum*. This plant is said to be particularly adapted to warm and hot regions in Argentina where alfalfa and the clovers do not flourish.

Lespedeza (Japan clover), S. H. Essary (*Tennessee Sta. Bul. 123 (1921), pp. 3–28, figs. 11*).—A general discussion of the principal factors affecting the successful production of lespedeza in the State, together with notes on weeds and insect pests. Improved varieties developed by the station are described and illustrated. It is noted that on the thin gray land at the West Tennessee Substation commercial fertilizers did not influence yields appreciably, but a marked increase resulted from liming.

Field peas for Wisconsin, E. J. Delwiche (*Wisconsin Sta. Bul. 329 (1921), pp. 24, figs. 11*).—A general discussion of the production and utilization of field peas in Wisconsin. The average yields for the period 1908 to 1917, inclusive, indicate that the crop pays better per acre than barley, oats, rye, wheat, or hay. The best varieties, as indicated in tests, are pedigree strains of Green, Scotch, and Marrowfat.

Potato improvement by hill selection, G. Stewart (*Utah Sta. Bul. 176 (1920), pp. 3–28, figs. 14*).—Progeny tests of the power of a strain of potatoes to transmit its desirable qualities to succeeding generations are described. From 1911 to 1913 high and low yielding hills, selected from three potato varieties, Bangor, Peerless, and Majestic, were planted in individual progeny rows and each hill harvested separately. Bangor and Peerless stocks were discarded in 1914 on account of inferior yielding power. Similar selections were continued from the Majestic variety until 1916, but thereafter only high-yield selections were made, with the exception of a few strains developing unusual foliage characters. Selection for gametic qualities was sought and somatic factors avoided.

By 1915 the high-yielding strains averaged 301 bu. per acre, as compared with 179.3 bu. for unselected. The six-year average (1915–1920) acre yield of the selected strain was 60.9 per cent greater and the average size of the tuber 24.4 per cent greater than those of the unselected stock. After the best tubers had been selected for seed, remnant hills and strains gave a yield somewhat poorer than unselected stock. Selected strains produced higher acre yields, more tubers per hill, larger individual tubers, and a higher percentage of marketable potatoes than the unselected stock. The germination of the selected strain was more rapid, the stand better, the growth thriftier, and diseases less apparent than for the unselected potatoes of the same variety.

Wisconsin rye, R. A. Moore and B. D. Leith (*Wisconsin Sta. Bul. 326 (1921), pp. 19, figs. 7*).—A general discussion of the practices involved in the production of rye in Wisconsin is presented, together with notes on the place of the crop in rotations, utilization, and the control of ergot.

In 1919 over 8,000,000 bu. of rye was produced in Wisconsin. The largest production is in the central and northwestern parts of the State, especially on the sandy areas. Comparisons of the 9-year average acre yields of the leading small grains at the station showed the pedigree varieties to rank as follows: Schlanstedt winter rye, 47.1 bu.; Turkey Red winter wheat, 37 bu.; Oderbrucker barley, 46 bu.; and Wisconsin Wonder oats, 75.7 bu.; or 2,638, 2,220, 2,208, and 2,422 lbs. per acre, respectively. Spring rye is not recommended on account of lower yields than the winter type, the 3-year average acre yield of two varieties of spring rye being 23.9 bu., of 47.4 lbs. weight, as compared with 44.1 bu., of 54.8 lbs. weight, from two varieties of winter rye.

Report on the sugar-cane experiments for the season 1918–1920, R. R. Hall and J. R. Bovell (*Barbados Dept. Agr., Rpt. Sugar-Cane Expts., 1918–1920, pp. 77*).—Variety and fertilizer tests with sugar cane in Barbados are reported in continuation of previous work (E. S. R., 42, p. 234). Results of tests of seedlings, plant and ratoon canes, and selected varieties of sugar cane grown on various experimental plats on different estates, and meteorological data are reported as usual in tabular form. The presence of the root borer (*Diaprepes abbreviatus* L.) and the brown hardback (*Phytalus smithi* Arrow) on the fertilizer plats rendered the results inconclusive.

Cuttings of large canes and small canes produced respective average acre yields of 29.48 and 26.88 tons of cane. In canes on which the tops were withered from attacks of the root borer and brown hardback, large cane cuttings produced 31.11 tons, as compared with 24.15 tons from small canes. Cuttings from healthy cane made 31.19 tons per acre and those from canes attacked by the moth borer (*Diatræa saccharalis* Fabr.) 33.86 tons. In each case canes not withered gave greater yields than those withered from attacks of root borer and brown hardback. On the other hand, canes from cuttings attacked by the moth borer gave better results than cuttings from canes not attacked by this insect. Cuttings from plant canes and first and second ratoons made average acre yields of 28.39, 26.95, and 28.32 tons, respectively.

Leading varieties in tests on plats in black soil districts with their acre production of muscovado sugar include Ba. 8409, 7,358 lbs.; B. S. F. 12(48), 7,158 lbs.; and Ba. 11403, 6,732 lbs.; as compared with White Transparent with 4,018 lbs. On red soils the leading varieties with tons of cane per acre include Ba. 6032, 32.05 tons; Ba. 12079, 32.02 tons; and B. H. 10(12), 30.67 tons. White Transparent, the standard cane, made 20.74 tons.

In tests of selected varieties for the years 1916–1920, inclusive, on black soil with plant cane, the highest yielding varieties with their yields of muscovado sugar were B. H. 10(12), 7,716 lbs.; Ba. 11403, 7,346 lbs.; and Ba. 6032, 7,146 lbs. White Transparent was twenty-third among the varieties, giving an average yield of 5,735 lbs. during the period. On red soil Ba. 6032, B. 6450, and Ba. 2471 were first, making yields of 37.44, 33.3, and 31.89 tons of cane per acre, respectively.

Annual white sweet clover and strains of the biennial form, A. J. Pieters and L. W. Kephart (*U. S. Dept. Agr., Dept. Circ. 169 (1921), pp. 21, figs. 8*).—The occurrence of annual white sweet clover, its growth, flowering habits, and uses are described, and the seed, plants, and growth habits of the annual and biennial forms of *Melilotus alba* compared. Notes on annual blossoming biennial forms, varieties and strains of the biennial form, and Grundy County and Arctic sweet clovers are also included. Earlier work with this clover has been noted (E. S. R., 44, p. 431).

The annual differs from the biennial form in its more rapid growth and maturity. Crown buds are not developed, but the plant dies after producing seed. When two or more crown buds develop on a biennial, the habit of the plant when in seed is distinct from that of a seed-bearing annual, but when only one crown bud develops, the biennial and the annual seed-bearing plants can not be distinguished with certainty. Seeds of the annual can not be distinguished from those of the biennial form.

Teff grass (Eragrostis abyssinica), J. BURTT-DAVY (*Johannesburg: Author, 1916, pp. 36, figs. 5*).—This publication treats of the history, geographical distribution, description, and uses of teff grass (*E. abyssinica*), and the cultural and field practices involved in its production in South Africa. See also earlier notes (E. S. R., 28, p. 738; 34, p. 435). A bibliography of 25 titles is appended.

[In a later communication the author states that "in 1919 the Union of South Africa grew just under 250,000 acres of teff, worth to the farmers of the country over £1,000,000. Teff hay has sold as high as £15 per ton (2,000 lbs.) in the Johannesburg market. These facts have come to light since the pamphlet was published."]

Connecticut Round Tip tobacco: A new type of wrapper leaf, D. F. JONES (*Connecticut State Sta. Bul. 228 (1921), pp. 285–292, pls. 2; also in Tobacco, 72 (1921), No. 2, pp. 5, 24, 25, figs. 4*).—A new type of wrapper leaf for priming, developed by 10 years of selection and testing at this station. The plant is described as a tall and vigorous grower, flowering and setting seed abundantly, and possessing a stronger root system than Havana. The leaves, 20 to 24 per plant, are smaller and more compact than Broadleaf. The length of leaf ranges from 16 to 26 in., but on account of the broad round shape, a 20-in. leaf is equal to a much larger leaf of either Havana or Broadleaf, and yields a greater number of wrappers pound for pound. Yields ranging from 1,600 to 2,000 lbs. per acre have been secured. Opinions of tobacco growers are appended.

Varieties of winter wheat adapted to the eastern United States, C. E. LEIGHTY (*U. S. Dept. Agr., Farmers' Bul. 1168 (1921), pp. 18, figs. 5*).—A revision of the material included in Farmers' Bulletin No. 616 (E. S. R., 32, p. 336).

Results of seed tests for 1920, M. G. EASTMAN (*New Hampshire Sta. Bul. 197 (1920), pp. 16*).—A report on the purity and germination of 563 official samples of agricultural seed collected during the year ended July 1, 1920.

HORTICULTURE.

[Report on horticultural investigations] (*Indiana Sta. Rpt. 1920, pp. 25–28, 29*).—This is mainly a progress report (E. S. R., 43, p. 337).

In the soil management investigations in the apple orchard at Laurel, Ind., the trees in the tillage and straw mulch plats continue to make the best growth. "Plats in grass but receiving grass mulch are next, and those in straight grass are making the poorest growth. The plat which was tilled the first five years and then seeded to grass made less growth during 1919 than the plat which had been planted in grass from the beginning of the experiment, but which has received additional mulch of straw since 1917, continues to show increased growth. The annual trunk gain made last year was nearly equal to that made by the plat which has received straw mulch since the beginning of the experiment. This plat, together with the plat which was seeded to grass after five years of cultivation, again emphasizes the rapidity with which trees will respond to changes in soil management.

"The first real crop of fruit was produced on these plats in 1919, although late spring frosts and heavy winds reduced the yield at least one-half. Production follows in direct proportion to growth and we find the cultivated and mulched plats leading in both growth and production. The production in 1919 on these two plats was practically seven times that of the straight grass plat.

Only 65 per cent of the trees on the grass plat fruited, while practically all under tillage and straw mulch fruited in 1919. Fertilizers on these plats showed beneficial effect, principally upon the cover crop and grass, but did not show noticeable results in fruit production."

Pruning experiments at Laurel, Bedford, and LaFayette gave additional evidence that heavy pruning of young trees not only reduced the size of the top but reduced the total growth of the root system as well. At Bedford, where half of a block of 4-year-old trees is under cultivation and half under sod, the tilled trees made 126 per cent greater gain in girth than trees in sod, whereas lightly pruned trees made 48 per cent more growth than heavily pruned trees, thus indicating that soil treatment has a greater effect on growth than pruning treatment.

Data secured in the dusting experiment at Peru confirmed the results of the previous year, namely, that dusting is more expensive and slightly less effective in controlling apple scab. Dusting controlled curculio and codling moth as effectively as spraying.

In orchard fertilization tests, nitrate of soda had little effect in three orchards under cultivation, but increased the yield of fruit 27 per cent in one orchard in sod.

Tomato fertilization experiments in 1919 indicate that the use of acid phosphate, in combination with nitrogen and potassium, is more profitable than acid phosphate alone. "Of some 15 different combinations of fertilizers 500 lbs. of a 2:12:6 gave the highest net profit. Six hundred lbs. of acid phosphate per acre alone yielded a net profit of $24.54 per acre, while a fertilizer of the above formula gave a net profit of $44.45 per acre. Check plats in this experiment showed a net loss in every instance. This loss was as high as $10.68 per acre. This work is being continued."

Indiana-grown onion seed was found to be equal to commercial stocks. Similar results were indicated in studies with Country Gentleman and Stowell Evergreen sweet corn and Irish Cobbler potatoes.

Studies in sweet pea germination indicated that sand is the best medium for varieties which ordinarily show poor germination. A higher percentage of germination was usually obtained under low temperatures, although high temperatures as in a rose house may hasten germination. Soaking seed in warm water for 18 hours proved highly satisfactory, but sulphuric acid is not recommended. Large seeds of all varieties gave better germination than smaller seeds of the same varieties.

The vegetable garden, J. G. MOORE (*Wis. Agr. Col. Ext. Circ. 132 (1921), pp. 36, figs. 12*).—Detailed instructions are given for the planning, planting, and care of the home vegetable garden. Directions for the storage of vegetables are included.

Vegetable growing, S. C. HARTMAN (*Ohio Sta. Bul. 344 (1920), pp. 362–366, figs. 2*).—Brief notes are given of the cost and returns per acre of cabbage, sweet corn, cucumbers, and tomatoes grown on the Washington County Experiment Farm.

The handling and transportation of cantaloups, A. W. MCKAY, G. L. FISCHER, and A. E. NELSON (*U. S. Dept. Agr., Farmers' Bul. 1145 (1921), pp. 23, figs. 10*).—This is a revision of Markets Documents 9 (E. S. R., 39, p. 240), and 10 (E. S. R., 39, p. 444).

Evaluation of climatic temperature efficiency for the ripening processes in sweet corn, C. O. APPLEMAN and S. V. EATON (*Jour. Agr. Research [U. S.], 20 (1921), No. 11, pp. 795–805, fig. 1*).—A contribution from the Maryland Experiment Station, dealing with the chemical changes in sweet corn during ripening and the effect of climatic temperature on the rate of these changes.

In a previous paper (E. S. R., 41, p. 646) the senior author and Arthur pointed out the rapid loss in sugars following the removal of the ear from the growing plant.

In this experiment an early and a late crop of Stowell Evergreen were used. Samples of kernels were taken at 48-hour intervals, commencing with the earliest usable stage of maturity. The late crop required 15 days to attain the same stage of maturity that the early crop reached in 6 days.

Data are presented in tabular form showing changes in composition of sweet corn during ripening, a comparison of early and late crops of sweet corn in respect to changes in percentage composition in equal lengths of time, temperature indices in relation to ripening of sweet corn, comparison of the rates of sweet corn ripening in different localities based upon the exponential indices corresponding to the normal mean temperatures of the ripening seasons, and the rate of sweet corn ripening during the month of August calculated from Baltimore temperatures. The authors point out the practical value of their experiments in determining the number of days that a crop of corn is in proper condition for harvesting.

The chilacayote or Siam gourd, L. T[RABUT] (*Rev. Hort. Algérie, 25 (1921), No. 2, pp. 17–19*).—A paper directing attention to the merit of this gourd as human food, and pointing out that despite the generally accepted idea of Asiatic origin this plant is a native of America.

Standard containers for fruits and vegetables, F. P. DOWNING (*U. S. Dept. Agr., Farmers' Bul. 1196 (1921), pp. 34, figs. 33*).—A contribution from the Bureau of Markets, presenting a study of containers used for marketing vegetables and fruits. The multiplicity in size and shape of containers is illustrated by photographs and tabulations of dimensions. It is pointed out that these variations have been the cause of much confusion, loss, and opportunity for fraud. The Federal laws regulating size of barrels, grape baskets, berry boxes, and till baskets are said to have done much for standardizing the marketing of certain fruits and vegetables, and further acts to include the bushel package and other receptacles are recommended and urged.

A handbook of hardy fruits more commonly grown in Great Britain, E. A. BUNYARD (*London: John Murray, 1920, pp. 205*).—An alphabetically arranged manual of apple and pear varieties, largely a compilation from other sources but supplemented with the author's observations and notes. Group classifications of varieties are included.

The annual review of new fruits, U. P. HEDRICK (*Rural New Yorker, 80 (1921), No. 4628, pp. 355, 360, figs. 4*).—A popular article directing attention to several new and meritorious varieties of fruits, a large proportion of which were originated at the New York State Experiment Station.

The handy book on pruning, grafting, and budding, J. UDALE (*Evesham [England]: W. & H. Smith, Ltd., Journal Press, 1920, 4. ed., rev. and enl., pp. 146, figs. 80*).—A treatise on the principles and practices of pruning fruit and ornamental plants and on grafting and budding. The introduction is by Cobham.

Bud selection with special reference to the apple and strawberry, V. R. GARDNER (*Missouri Sta. Research Bul. 39 (1920), pp. 3–30*).—A report of bud selection studies with the apple and strawberry at the Missouri Station and with the strawberry at the Oregon Station. An earlier paper has been noted (E. S. R., 43, p. 536).

The Missouri experiments were begun in 1895 and conducted over a period of 23 years. The materials utilized were Ben Davis apple trees, propagated from the highest and lowest yielding trees in an orchard of over 200 individuals, and strawberry plants, propagated from highest and lowest yielding individuals of a single variety. The results of the Missouri experiments, previously noted (E. S. R., 33, p. 236), are summed up by the author, as follows:

"The apple trees propagated from the high-yielding parent averaged about the same in quantity and grade of fruit produced as those propagated from the low-yielding parent. The two lots of trees alternated with each other in their seasons of heavy and light bearing. There was a large amount of variation between the individual trees in each lot. Ten successive generations of runner selection from high-yielding and from low-yielding strawberry plants at the Missouri Station failed to produce strains whose yield was higher or lower than the average of the variety."

The Oregon experiment, begun in 1913 and extending over a period of five years, is reviewed in detail. Productive and unproductive individuals of several strawberry varieties and seedlings were selected in 1913 and 1914, and with the exception of 1915, when frosts destroyed the crop, careful records were made of the yield of the original selections and their progeny. These records are presented in tabular form. "When the variations due to seasonal and other more or less obvious causes are accounted for, it is evident that on the whole there has been very little difference in the yields that have been obtained from the daughter plants of high-yielding and those of low-yielding individuals. The daughter plants of low-yielding individuals outyielded those of high-yielding individuals as often as they underyielded them. . . .

"Apparently most of the individuals chosen as starting points for the bud-selection work, like those chosen by the Missouri Station, simply represented extreme degrees of development that were in the nature of fluctuating variations—variations that could not be perpetuated by bud propagation. On the other hand, the selections made from Station Seedling No. 87 produced runners that did show a marked tendency to perpetuate the high and low producing qualities of the mother plants. . . . Selection B of this variety was barren the first year, and the second year it produced only a single flower cluster, while selection A was moderately productive. For three successive seasons the daughter plants of selection A yielded practically twice as much as those of selection B. The low yield of the daughters of selection B was due to two factors: (1) Some of these daughter plants bore nothing at all, remaining barren; (2) those which did produce bore lightly. . . . Evidently here was the beginning of two distinct strains, a productive or normal strain and an unproductive or semibarren strain. In this one instance bud selection had served to segregate these two forms. It is interesting to note in passing that the variation from the normal form, which in this case could be perpetuated, was in the direction of deterioration or degeneration. From a practical viewpoint, all bud selection accomplished was to keep the variety up to its own standard by the weeding out of an infertile or semibarren strain."

Observations made upon the sudden loss of vigor in all or part of the individuals of certain station seedling strawberries are included and discussed by the author, who concludes that this degeneration is a form of bud variation. A notable variation in the vigor of five lots of Marshall strawberry plants, obtained from widely separated sources, led the author to advise greater care in the testing of accessions, allowing reasonable time for acclimatization.

Crosses made in 1914 between the Wilson variety and plants of the wild *Fragaria chiloensis* yielded one seedling plant which bore two kinds of petioles, one with spreading and one with appressed and ascending pubescence. Of 79 stoloniferous progeny obtained from this plant in 1915, 75 were like the mother, 2 had petioles bearing appressed and ascending pubescence, and 2 had petioles with spreading pubescence. The author terms the condition of the mother plant as that of "divided dominance" and adds: "Of course. these particular bud variations are of no value either to the strawberry grower or the strawberry breeder, but they are interesting in that they show that strains may arise in the strawberry through bud variation which are not in the nature of degenerate forms and which theoretically at least might be the means of providing improved strains."

Renewing old orchards in Kentucky, first year results in a five-year program, H. R. Niswonger (*Ky. Agr. Col. Ext. Circ. 90* (*1921*), *pp. 15, figs. 8*).—A report of demonstrations in seven neglected Kentucky farm orchards varying in size from 18 to 125 trees and in age from 12 to 20 years. The trees were pruned, sprayed, and the soil improved by application of manure at the rate of 1 ton for three trees or, where no manure was available, nitrate of soda at the rate of 5 to 8 lbs. per tree, dependent on the age of the tree. Cost of all renovation operations are presented in tabular form and summarized, showing an average net profit of $1.53 for each of the 387 trees involved.

Dusting v. spraying for insect control, T. J. Headlee (*Peninsula Hort. Soc.* [*Del.*] *Trans.*, *34* (*1921*), *pp. 51–60, fig. 1*).—This paper discusses the comparative merits of dusting and spraying for the control of insect pests and records experiences in New Jersey during the years 1919 and 1920. A chart is included graphically illustrating the relation of New Jersey rainfall in 1919 and 1920 to the time of application of dusts and the periods during which such applications must remain on the tree to be effective. Heavy rains were found to wash off the dust promptly and light rains to be harmful when extending over a long period. Dusting experiences of 1919 and 1920 show a marked correlation between the presence or absence of heavy rains and the number of codling moth worms.

The author concludes in part that, "the best that can be claimed for the dust under most favorable average conditions is that it is about as good as the spray, and this seems to indicate that the unreliability is upon the side of the dust. In New Jersey the evidence in favor of greater efficiency on the part of the liquid applied materials is clear and definite for control of curculio and codling moth. The failure of the dust in the New Jersey experience in 1919 and 1920 seems to be chargeable to its having been washed off the tree, either by small rains covering a long period or by heavy rains covering short periods."

Dusting experiments in peach and apple orchards in 1920, F. D. Fromme, G. S. Ralston, and J. F. Eheart (*Virginia Sta. Bul. 224* (*1921*), *pp. 12, figs. 2*).—A further report on dusting investigations in Virginia orchards (E. S. R., 42, p. 345).

"The work on peaches was conducted in three orchards at Crozet, Va. There were five plats in each orchard, three were dusted with sulphur dust, one was sprayed with arsenate of lead and self-boiled lime sulphur, and one served as a check. The number of applications on the dusted plats varied from 5 to 8, one plat receiving 5 applications, one 6, and one 8. The number of applications on the spray plats was 3, which is the standard schedule for this State." Data were obtained from counts of all peaches from six trees of each plat and are presented in tabular form.

"Scab was the most prevalent disease and the injury caused by the green soldier bug the most prevalent insect injury. Brown rot, unfortunately, was slight in all three orchards. The extra number of dust applications were planned with the control of this disease in view. Next to scab, the most common cause of defective fruits was a type of cracking, which was largely confined to the dust plats." The authors state that this injury was apparently due to a combination of factors, excessive dust materials, and unusual weather conditions; and the results of a single season should not be accepted as a judgment againt dusting. Curculio infestation was too slight to indicate the efficiency of the material. "Our experience with peach dusting, therefore, may be summed up in the statement that the dusting materials have given very satisfactory control of scab, and that the data with respect to the control of brown rot and curculio are insufficient for drawing conclusions."

The experiments on apples were conducted in two orchards, one at Harrisonburg, where the control of scab was the principal object, and one at Crozet, where bitter rot was the chief disease. In the Harrisonburg orchard, composed of 11-year-old Winesap and Stayman trees, scab had been very severe in 1919. Seven applications were made on all the treated plats. "Scab was the only disease present to any extent. There was no bitter rot whatever, and codling moth was so slight as to be negligible. The few wormy apples were quite uniformly distributed over the plats. . . . Scab infection on Winesap was considerably more severe than on Stayman, about three times as much on the average. This is due to the difference in the susceptibility of the two varieties.

"All three spray mixtures gave good control of scab, the Bordeaux mixture being apparently somewhat less efficient than the other two. Unfortunately, there was no fruit of the Winesap variety in the lime sulphur plat and not enough in the dry lime sulphur plat (only 68 apples) to serve as a basis for conclusions. The sulphur dust was by far the most efficient of the three dust mixtures, and this material compared very favorably with the spray mixtures in scab control, the percentages of efficiency being 88 for Winesap and 92 for Stayman. Neither the copper-lime nor Bordeaux dust gave sufficiently good control of scab to warrant their use, and both caused some russetting of the fruit. Some russetting was present in all of the spray plats also, but it was not severe enough to be commercially important. The sulphur dust was the only material that did not cause russetting."

The Crozet orchard consisting of 30 large Albemarle Pippin trees was divided into four plats, one of which was sprayed with lime sulphur followed by applications of Bordeaux, with lead arsenate used in the first three of the total six treatments; two plats were dusted with copper-lime mixture in proportions of 10:10:80 and 5:10:85; and one plat served as control. Although bitter rot was not especially severe, an adequate test of the materials was obtained. Codling moth was much more severe than in the Winesap and Stayman orchard. "Neither of the copper-lime mixtures proved at all satisfactory from the bitter rot standpoint. By comparison with the check they apparently did not have any value whatever in the control of this disease. The Bordeaux spray, on the other hand, gave almost perfect control and reduced bitter rot infection to a negligible amount. The spray applications were also more effective in the control of codling moth than the copper-lime dust."

A summary of results for 1917, 1919, and 1920 is shown in tabulated form and leads to the following observations: "None of the dust mixtures has proved sufficiently effective in the control of bitter rot to warrant its use. . . . It is apparent that none of the dust mixtures should be used in orchards where bitter rot is apt to be prevalent. There seems to be no justification for the use of any of the copper dusting mixtures in Virginia apple orchards. The sulphur dust mixtures, the 40:40:20 in 1917 and the 80:10:10 in 1919, have proved practically as efficient in the control of codling moth as the corresponding spray materials. This is also true for the Bordeaux dust, but the copper-lime dusts have not proved as effective as the spray mixtures."

Experiments in dusting and spraying peaches for the control of curculio, brown rot, and scab, O. I. Snapp and L. Pierce (*Mississippi Sta. Bul. 195 (1920), pp. 8*).—A report of a single season's investigations conducted in cooperation with the station by the U. S. Department of Agriculture near New Albany, Miss., in which a study was made of the comparative efficiency of dusts and spray for the *control of curculio*, brown rot, and scab of the peach. The 716 Belle of Georgia and Carman peach trees utilized in the experiment were divided into seven nearly equal plats, five of which were treated with dusts, one with spray, and one left untreated as check. Results were determined by counts of sound and unsound fruits on 10 central trees of each plat and by gross yield of the entire plats.

Of the six treated plats, the spray gave the highest percentage of No. 1 commercial fruits and next to the highest percentage of sound fruits. The dust mixture of 10 per cent lead arsenate, 10 per cent lime, and 80 per cent sulphur, when used in all three applications, gave the highest percentage of sound fruit, but its use resulted in serious defoliation and consequent loss of quality in the fruits. A dust mixture in which 15 per cent lead arsenate was used in two of the three applications also caused serious defoliation, leading the authors to conclude that this percentage of lead arsenate can not be safely used on peach foliage. A study of the cost of dusting *v.* spraying resulted in the conclusion that, when the cost of application of material is considered, there is little difference. Dust and spray calendars are included.

Desirable cherries for cultivation, L. Chasset (*Rev. Hort.* [*Paris*], *93* (*1921*), *No. 16, pp. 274, 275*).—Brief notes on varieties of cherries deemed worthy of more extended use.

Specific results in pollinating the Bartlett pear, W. P. Tufts (*Better Fruit, 14* (*1919*), *No. 3, pp. 5, 21, 22, figs. 2*).—A popular presentation of investigations already noted from another source (E. S. R., 41, p. 240).

A native prune, L. R. Detjen (*Peninsula Hort. Soc.* [*Del.*], *Trans., 34* (*1921*), *pp. 37–42*).—Attention is directed to a supposedly new variety of plum, named by the author the Herald, which although apparently of native American stock has the prune characteristics of clinging to the tree and drying without decaying. The author describes the dried fruit as of inferior quality, but points out the potential value of the variety as a possible founder of a new race of prunes.

Varieties of grapes, J. C. C. Price (*Alabama Col. Sta. Bul. 211* (*1920*), *pp. 35–50, figs. 15*).—A variety test of grapes begun in 1912 is reported.

"The following 11 varieties remained healthy throughout the six years' test and produced good crops of fruit, showing their ability to withstand adverse conditions, and should be selected for either home or commercial planting in Alabama: Brighton, Catawba, Concord, Delaware, Diamond, Ives, Isabella, Moore, Niagara, Worden, and Winchell." Six varieties of rotundifolia grapes included in the trial proved of value. "The Scuppernong, a name applied to all greenish white rotundifolia grapes, is especially prized for eating out of hand; the Eden and Misch for their peculiar, musk flavor; the James for its immense size; the Thomas for its extra value for culinary purposes; and the Flowers for its late ripening period. This class of grapes has a longer season than the bunch grapes and should be more generally grown. Its season is later than bunch grapes, thus prolonging the period for fresh grapes."

Brief descriptive notes are given for the 54 varieties tested.

"Yema" budding of the vine, H. L. Manuel (*Agr. Gaz. N. S. Wales, 32* (*1921*), *No. 3, pp. 197–199, figs. 3*).—A brief article on the merits of the "Yema" method of grafting the grape. In contrast to the usual process, this operation is performed in summer after the strong flow of sap has ceased, and instead of cutting off the plant at the surface of the ground a chip bud is inserted in a prepared groove and the stock allowed to grow until the bud is established. This process is valued in phylloxera-ridden areas.

[New small fruits and grapes], R. Wellington (*Canad. Hort., 44 (1921), No. 5, pp. 73, 74, fig. 1*).—Attention is drawn to several new varieties of strawberries, raspberries, and grapes which, according to the author, show sufficient merit to warrant their trial by fruit growers.

The Colombian berry or giant blackberry of Colombia, W. Popenoe (*Jour. Heredity, 11 (1920), No. 5, pp. 195–202, figs. 5*).—A popular account of a large-fruited species of Rubus found growing wild in the highlands of Colombia, with notes concerning botannical nomenclature and description of plant and fruit.

Pineapple culture in Cuba, B. Muñoz Ginarte (*Estac. Expt. Agron. Cuba Bol. 45 (1919), pp. 48, figs. 16*).—A comprehensive and practical bulletin on the pineapple-growing industry in Cuba. Soil requirements, varieties, propagation, cultural practices, fertilizers, insect and fungus pests, harvesting, marketing, returns, and methods of utilizing the fruit are among the points discussed.

The cultivation and uses of roselle, P. J. Wester (*Philippine Agr. Rev., 13 (1920), No. 2, pp. 89–99, pls. 5, fig. 1*).—This paper contains practical information relative to the roselle, its introduction and behavior in the Philippines, varieties, culture, uses, etc., including recipes.

[Economic plants in Uganda], J. D. Snowden, C. Hazel, and W. Small (*Uganda Dept. Agr. Ann. Rpt., 1920, pp. 15–20, 22, 24–28, 42–44*).—Cultural and varietal experiments with cacao, coffee, and tea are reported, together with results of tapping experiments with Hevea at Entebbe and Kampala. A list of various fruit and economic plants cultivated at Kampala is included.

Pecan pollen, E. E. Risien (*Amer. Nut. Jour., 14 (1921), No. 5, p. 54*).—Brief notes are given of the author's methods of technic in pecan breeding. In place of the usual paper sack for covering the pistillate flower, the bloom is inclosed in a capsule attached to a branch by a fine copper wire. Fertilization is obtained by placing within the capsule a small amount of absorbent cotton previously dipped in the pollen of the desired variety. The author states that he has repeatedly fruited new seedlings in five years from seed.

Ginseng culture, W. W. Stockberger (*U. S. Dept. Agr., Farmers' Bul. 1184 (1921), pp. 15, figs. 3*).—A revision of Farmers' Bulletin 551 (E. S. R., 29, p. 639).

The importance of plant quarantine service in the Philippines, G. Merino (*Philippine Agr. Rev., 13 (1920), No. 2, pp. 117–125*).—A paper pointing out the importance of plant inspection service to the Philippines. Previous to the inauguration of the service, in 1915, many disastrous pests had been introduced, for example, coffee blight. The organization and operation of the Philippine inspection service is discussed and compared to that of Japan in an effort to emphasize the necessity of improving and extending the service.

FORESTRY.

Studies in forest tree seeds: Relation between germination and soil moisture, E. N. Munns (*Natl. Nurseryman, 29 (1921), No. 5, pp. 115–117, figs. 4*).—A report of investigations concerning the relation between germination of forest tree seeds and the amount of moisture in the soil. The work was carried on at the Converse Experiment Station of the U. S. Forest Service in Southern California, and extends over the period 1915–1920.

The maintenance of soil moistures of 10, 15, and 20 per cent in seed beds of yellow pine (*Pinus ponderosa*) resulted in germinations of 41, 78, and 93 per cent, respectively, with marked variations in rate. A further test in cans of sand, in which the moisture ranged from 5 to 40 per cent at 5 per cent intervals, gave respective germinations of 6, 38, 95, 87, 69, 26, 3, and 0 per cent. Similar tests with several other species led the author to observe that each species evidently has an optimum range of soil moisture for the germination of its seeds. A fluctuation in the moisture content resulted in decreased germinations of both *P. ponderosa* and *P. jeffreyi* and in a longer time required for germination.

The author points out the possible value of his study in solving certain forest problems. The data relative to the various species are illustrated by graphs.

Determination of the increment of trees by stem analysis.—I, Eucalyptus viminalis Labill., W. A. W. DE BEUZEVILLE (*Roy. Soc. N. S. Wales, Jour. and Proc. 53 (1919), pp. 239–245, figs. 6*).—In this paper, presenting an analytical study of a typical tree of *E. viminalis* in which the diameter and age was determined at various heights, age was based on the number of concentric rings, assuming that each ring represented one year's growth. The data, presented in tabular form and graphically delineated by means of curves, show the relation of height, diameter, volume in cubic feet, and rate of increment of volume to age. The correlation of height and volume to diameter is also illustrated.

Adaptation in Douglas fir, J. V. HOFMANN (*Ecology, 2 (1921), No. 2, pp. 127–131*).—Studies are reported concerning the transmission of inherent tendencies in the Douglas fir. Modifications of the parent trees due to soil, age, elevation, locality, health, and density of stand were found to exert an influence on the vitality of the seed and in some measure on the growth of the seedlings. The data, based on six annual germination tests and on the growth of one-year seedlings from each test, are presented in tabular form.

"The outstanding conclusion is that the variations in vitality of seed and vigor of seedlings, caused by the environmental condition of the parent tree, are not sufficiently pronounced to justify radical methods of management which may favor one or another of the factors. In so far as seed production, vitality of seed, and vigor of seedlings are concerned, there need be no selection of seed trees based on age, health, or soil in which they are growing which will in any way interfere with the best economic utilization of the stand." A general tendency was found for seed to decrease in vitality as the age of the parent increases.

The Macedonian pine (Pinus peuce), S. MOTTET (*Rev. Hort. [Paris], 93 (1921), No. 14, pp. 244–246, figs. 2*).—This article contains brief descriptive notes on this little-known species of pine.

Notes on Eucalyptus, VII, VIII, J. H. MAIDEN (*Roy. Soc. N. S. Wales, Jour. and Proc., 53 (1919), pp. 57–73, 107–115*).—In continuation of previous articles (E. S. R., 42, p. 348), further notes are given on Eucalyptus species and six new species are technically described.

[Cultivated timber trees for South Africa], T. R. SIM (*So. African Jour. Indus., 3 (1920), Nos. 9, pp. 783–793; 10, pp. 950–958; 11, pp. 1030–1039; 12, pp. 1155–1172; 4 (1921), Nos. 1, pp. 65–75; 2, pp. 161–165*).—A discussion of forest-tree species which have demonstrated their value for South African conditions. The timber requirements of South Africa, the geographical areas from a forest viewpoint, and the superior value of exotic to indigenous species are discussed in the initial article. A list of tried and recommended species is presented in tabular form and enlarged with a discussion of the habits, qualities, and requirements of the various trees.

Swedish forests, lumber industry, and lumber export trade, A. H. OXHOLM (*U. S. Dept. Com., Bur. Foreign and Dom. Com., Spec. Agents Ser., No. 195 (1921), pp. 282, pls. 53, figs. 32*).—This contribution presents comprehensive information on the forests, lumber industry, and lumber export trade of Sweden, based on eight months' first-hand observations by the author. The subject is treated under three general headings: (1) Forest resources and logging and floating operations, (2) lumber manufacture, and (3) the lumber export trade. Appendixes giving the imports and exports of lumber in tabular form are included. The text is well illustrated by photographs and maps.

Lumber markets of Spain and Portugal, N. C. BROWN (*U. S. Dept. Com., Bur. Foreign and Dom. Com., Spec. Agents Ser., No. 201* (*1921*), *pp. 151, pls. 15, fig. 1*).—This contribution presents a detailed study of the lumber markets of Spain and Portugal, especially in relation to present and future needs and means of increasing and improving the trade from the United States. Statistical tables relating to imports of lumber into Spain and Portugal are included.

Eighth biennial report of the State Board of Forestry of the State of California, G. M. HOMANS (*Calif. State Bd. Forestry Bien. Rpt., 8* [*1919–20*], *pp. 64, figs. 6*).—In this, the usual biennial report (E. S. R., 40, p. 744), a forestry policy is outlined in which fire protection is deemed of major importance. The proceedings of a conference on conservation between the State board and the lumbermen of the State are included. Information is also presented relative to the State fire organization in 1919 and 1920, forest and grain and hay fires, 1916–1920, the State nursery, highway planting, educational and experimental work, and finances.

[Report of the] division of forestry, R. D. FORBES (*La. Dept. Conserv. Bien. Rpt., 4* (*1918–1920*), *pp. 43–63, pl. 1, figs. 5*).—The usual biennial report along the lines of forest fire protection, investigations, and educational activities (E. S. R., 39, p. 450). A statistical appendix is included, giving data relative to timber resources, forest fires, etc.

Report on forest administration in the Andamans for the year 1918–19, W. R. LEG. JACOB (*Andamans Forest Admin. Rpt. 1918–19, pp.* [*3*]+*VII*+*38*).—This is the customary report (E. S. R., 39, p. 547).

Progress reports of forest administration in the Jammu and Kashmir State for the years 1916–17 and 1917–18, B. O. COVENTRY (*Jammu and Kashmir* [*India*], *Forest Admin. Rpts., 1916–17, pp. II+23+LI; 1917–18, pp. II+23+LIV*).—The usual annual reports (E. S. R., 37, p. 650).

DISEASES OF PLANTS.

[Plant disease investigations] (*Indiana Sta. Rpt. 1920, pp. 15–17*).—The occurrence of a new bacterial disease of tomatoes is reported, the disease being characterized by spotting of the leaves, stems, and fruits. Leaf and stem infection may cause serious injury to the plants, but the greatest damage is said to be due to the black, scabby spots occurring on the fruit. Practically all varieties of tomatoes are said to be susceptible. It is believed that the spread of the disease under field conditions is effected largely through insects. The bacteria causing the disease are said to be very resistant to drying and are carried over winter dried on the surface of the seed. Numerous tests with heavily inoculated seed has proved that a 5-minute immersion in a 1:3,000 solution of corrosive sublimate kills all the bacteria and does not injure the seed.

Field observations are said to have shown that tomato mosaic is an important disease in Indiana. It has been found that the disease attacks the ground cherry and apparently lives over winter in the rootstock of this plant.

Field investigations indicated that the disinfection of potato tubers with corrosive sublimate or formaldehyde will control the scab and black scurf of potatoes. A brown discoloration of the vascular system at the stem end of potatoes was found to be due to a species of Fusarium, and it is considered advisable to test all tubers by cutting the stem end and discarding those showing discoloration as a means for the prevention of the Fusarium wilt. A test of seed potatoes secured from Maine and planted in two localities in Indiana is said to indicate that mosaic disease may be present in the Indiana potato crop without showing typical symptoms, and it is thought that this may be the cause of the low yields secured in some localities.

Notes are given on some onion diseases, and the formaldehyde drip method for the control of smut is advocated. Anthracnose, pink rot, and Fusarium bulb rot are also said to be found in some localities. A nonparasitic trouble, which is attributed to an excess of soluble salts, is said to cause considerable irregularity of stands of onions in some soils.

In continuation of work on the foot rot of wheat, one season's investigations are said to indicate that the disease persists in the soil, 26 per cent of the plants being infected when grown on previously infected lands.

From the results of experiments carried on in 1919, it appears that the dormant spray does not diminish blotch infection on the fruit and foliage of apples.

Sulphur as a fungicide, B. T. P. Barker, C. T. Gimingham, and S. P. Wiltshire (*Univ. Bristol, Agr. and Hort. Research Sta. Ann. Rpt., 1919, pp. 57–75; also in Jour. Bath and West and South. Counties Soc., 5. ser., 14 (1919–20), pp. 144–163*).—This account of investigations on the fungicidal action of sulphur and certain of its compounds, which were begun early in 1919, though regarded as a preliminary report, presents in condensed form results of many series of experiments, which have covered a very wide field.

The central problem of the investigations here recorded was to determine how sulphur acts as a fungicide, the question of the action of sprays of the sulphid and polysulphid type being also involved. It was found that sulphids and polysulphids decompose rapidly after spraying, sulphuretted hydrogen being given off in gaseous form, and finely divided sulphur being deposited at the same time. This action appears to be accelerated by the presence of carbon dioxid in the atmosphere.

In addition to the sulphur the solid residue of the spray contains small quantities of the sulphate and thiosulphate salts of the particular base used and also the carbonate of the base. Thus, lime sulphur gives a deposit of sulphur mixed with calcium sulphate, thiosulphate, and carbonate, and liver of sulphur the corresponding potassium salts. Ammonium polysulphid does not give the same proportion of solid residue, owing to the volatilization of the ammonium compounds.

In regard to the toxic action of the sprays, a triple effect has been demonstrated. At the moment of application a direct toxic action sets up, due to the presence of sulphids and polysulphids as such. Their immediate action on fungi is doubtless supplemented to some extent by the sulphuretted hydrogen which at once develops.

The method of action of sulphur itself, as the chief active agent, is discussed in connection with three hypotheses which have been advanced, and with a fourth suggestion, that of the conversion of the sulphur into sulphuric acid. While sulphur is not sufficiently soluble in water to enter the cell to a toxic extent in ordinary aqueous solution, it is thought that the fluid which bathes the cell wall may possess greater solvent properties than water. It may therefore convey to the cell a toxic dose of sulphur, or this fluid, which probably contains organic matter, may act chemically on the sulphur, with the resultant formation of a toxic sulphur compound, possibly of a sulphid or polysulphid character. The third suggestion is based on the idea that matter in the form of finely divided and actively disseminated particles possesses peculiar properties of an irritant character which stimulate, to an injurious extent, cells exposed to their action. The account of experiments made at Long Ashton is thought to show that under ordinary practical conditions none of these hypotheses meet the case.

Critical experiments recently carried out are said to have demonstrated the method by which sulphur at a distance from the plants under treatment (as in the hot water pipe method in a greenhouse) is brought into contact with the fungus. It is intended to publish shortly the details of these experiments. The case of sulphur applied at a distance is thus brought into line with that of sulphur applied directly to the plant by wet or dry spraying.

Amylase of Rhizopus tritci, with a consideration of its secretion and action, L. L. Harter (*Jour. Agr. Research* [*U. S.*], *20* (*1921*), *No. 10, pp. 761–786*).—A description is given of investigations of enzyms secreted by *R. tritici*, the work having been carried on in the Bureau of Plant Industry, U. S. Department of Agriculture. This fungus is said to secrete a vigorous starch-splitting enzym which acts on raw sweet and Irish potato starch, but more energetically on starch paste.

Dried mycelium stored at 9 to 35° C. for several months shows little deterioration as regards the enzym, but at 60° the enzym weakens gradually. The optimum temperature for starch digestion is about 45°. Hydrolysis is destroyed by maintaining a temperature of 60° for about 100 hours. Glucose retards hydrolysis, but not proportionately to the quantity added.

Temperature influences markedly the production of intercellular amylase. Results observed seem to show that there is a quantitative regulation of the enzym. The enzym powder of young mycelium just beginning to fruit was more active than the enzym from old mycelium.

A critical study of the slime molds of Ontario, M. E. Currie (*Roy. Canad. Inst., Trans., 12* (*1920*), *No. 2, pp. 247–308, pls. 3*).—This paper embodies the results of critical studies of a large number of gatherings of Myxomycetes, mainly from Ontario, representing 29 genera and 117 species and varieties. Grasses or herbaceous plants are parasitized and in some cases at least injured by *Diachaea leucopoda*, *Diderma effusum*, *D. testaceum*, *Didymium squamulosum*, *Fuligo septica*, *Leocarpus fragilis*, *Mucilago spongiosa*, *Physarum cinereum*, and *P. sinuosum*.

Culture studies with rust fungi, H. Klebahn (*Ztschr. Pflanzenkrank., 26* (*1916*), *No. 5, pp. 257–277, fig. 1*).—A continuation of reports previously noted (E. S. R., 31, p. 540) deals with several rust fungi and phases thereof, also with certain hosts, and briefly with problems of overwintering in the soil.

Effect of hot-water treatment on germinability in cereals, G. Lakon (*Ztschr. Pflanzenkrank., 27* (*1917*), *No. 1, pp. 18–25*).—The effects on germinability and growth of the fungicidal hot-water treatments are discussed in connection with data presented in tabular form.

[Complete life cycle of leaf rust determined] (*Indiana Sta. Rpt. 1920, p. 13*).—It is reported that greenhouse investigations have resulted in the discovery of the aecial stage of the leaf rust of wheat, demonstrating for the first time the complete life cycle of that rust. The investigations have also shown that various species belonging to one genus of the family Ranunculaceae are the alternate hosts for the leaf rust of wheat. Considerable progress is reported on the study of biologic forms of leaf rust, and it is claimed that two fairly distinct strains of the orange leaf rust of wheat are present in this country.

Influence of Tilletia tritici on the host, W. Lang (*Ztschr. Pflanzenkrank., 27* (*1917*), *No. 2–3, pp. 89–99*).—It is stated that in this study a strain of wheat showed important modifications of the host plant in association with the presence of Tilletia. One of these was a severe check to growth, another an extraordinary susceptibility to yellow rust. This influence proceeds not from the growing fungus, but from the excretions produced by the hyphæ. The chemical constitution of the substances involved is not known. It appears probable that it influences the composition and activity of the chlorophyll-bearing cells, and that in this way are brought about the check to growth and the sensitivity to rust.

A transmissible mosaic disease of lettuce, I. C. JAGGER (*Jour. Agr. Research [U. S.], 20 (1921), No. 10, pp. 737–740, pl. 1*).—In a contribution from the Bureau of Plant Industry, U. S. Department of Agriculture, the author describes a disease of Romaine lettuce that appeared in a field at Sanford, Fla., in January, 1920. At the same time a variety of head lettuce in a neighboring field developed a similar condition, but in most cases the blotching was less marked and there was an absence of the decided mottled appearance observed in the Romaine lettuce.

The author considers the disease infectious and apparently caused by a parasite not capable of isolation through ordinary technic. The disease has been transmitted experimentally from diseased to healthy plants by means of aphids, particularly *Myzus persicae*. From the symptoms and general character of the disease, it is considered to be a true mosaic disease of lettuce.

Potato canker, E. SCHAFFNIT and G. VOSS (*Ztschr. Pflanzenkrank., 26 (1916), No. 3–4, pp. 183–192*).—Studies were carried on during 1915 in connection with the fungicidal qualities of eight disinfectants named and the resistance of a number of different potato varieties. The results are tabulated in detail. Apparently the spores of *Chrysophlyctis endobiotica* persist in the soil for seven or eight years.

Cercospora disease of potato in lower Austria, K. VON KEISSLER (*Ztschr. Pflanzenkrank., 27 (1917), No. 2–3, pp. 111–114, fig. 1*).—An account of observations on potato disease associated with *C. concors* stated that while *C. solanicola* and *C. heterosperma* were present in the leaves, each seemed to be independent and to exercise no injurious influence on the plant.

Inner splitting of potato tubers, H. ZIMMERMANN (*Ztschr. Pflanzenkrank., 26 (1916), No. 5, pp. 280–285, fig. 1*).—Observations discussed are summed up in the statement that the inner cracking (often associated with blackening) of potato tubers is due to use of one-sided nitrogenous fertilizer and with relatively small starch content in the middle of the tuber where the cracks occur.

Leaf roll, net-necrosis, and spindling sprout of the Irish potato, E. S. SCHULTZ and D. FOLSOM (*Jour. Agr. Research [U. S.], 21 (1921), No. 1, pp. 47–80, pls. 12*).—The results are given of a cooperative investigation carried on by the Bureau of Plant Industry, U. S. Department of Agriculture, and the Maine Experiment Station on the symptoms and means of transmission of these diseases.

The form of potato leaf roll which was a subject of this study is considered to be a nonparasitic transmissible disease which is widely distributed. The chief and perhaps the only manner of transmission from season to season is by means of tubers from diseased plants. Leaf roll usually reduces the yield considerably, and, as the disease is inheritable, it decreases the value of the tubers for seed. It is transmissible from one plant to another by means of grafting either tubers or stalks and by means of aphids. Inter-regional differences in the spread of leaf roll may depend upon differences in climate and in the abundance of aphids.

Net-necrosis is considered a leaf roll symptom, being a discoloration which results from tuber phloem-necrosis. It develops in the dormant tubers without relation to differences in storage temperature. When it occurs as a symptom of leaf roll, the effects are prominent, one being a decided spindliness of the sprouts.

Leaf roll and mosaic are considered somewhat similar types of diseases. Roguing has proved to be much more effective in eliminating leaf roll than it has been for mosaic, at least in northeastern Maine.

Soil sterilization, C. T. Gimingham and G. T. Spinks (*Univ. Bristol, Agr. and Hort. Research Sta. Ann. Rpt., 1919, pp. 37–42; also in Jour. Bath and West and South. Counties Soc., 5. ser., 14 (1919–20), pp. 126–132*).—An account is given of soil sterilization experiments for the control of potato wart disease, *Synchitrium endobioticum*, the results of which, within the limits here observed, do not seem very promising. The only treatment which completely killed the fungus in the soil was steam sterilization.

An account is given of the apparently spontaneous disappearance of Rhizoctonia from plats of ground on which that fungus had for several years attacked asparagus and carrots.

Nematode attack on potato, H. Zimmerman (*Ztschr. Pflanzenkrank., 30 (1920), No. 4–5, pp. 139–145, figs. 4*).—An account of a study covering several years of nematodes attacking potato concludes with recommendations regarding control which include avoidance of infected ground for use with potatoes during at least three years after a known infection.

The Typhula rot of sugar beets on the Azores and its control, E. Molz (*Ztschr. Pflanzenkrank., 30 (1920), No. 4–5, pp. 121–139, figs. 7*).—*T. betae*, an occasional parasite in Germany, is a serious beet disease in the Azores. An account of a biological study of *T. betae* states that mycelial development is greatly favored by warmth, moisture of the air, and the presence of oxygen. This fungus utilizes sugar in the beet as a carbon source, the mycelium making slow growth on low sugar content. Light favors the formation of sclerotia, as does also increased transpiration, which is prevented by high humidity. Control measures are indicated.

Sugar cane gummosis, its cause and control, G. Wilbrink (*Arch. Suikerindus. Nederland. Indië, 28 (1920), Nos. 33, pp. 1399–1462; 34, pp. 1463–1525*).—An elaborate account is given of studies on sugar-cane gummosis, including the probable systematic relations of the causal organism. This is said to be an aerobic bacterium transmissible in diseased plant material and perhaps on the tools used in cutting up the stalks to be used in planting for the new crop.

Spraying trials, G. T. Spinks (*Univ. Bristol, Agr. and Hort. Research Sta. Ann. Rpt., 1919, pp. 43–45; also in Jour. Bath and West and South. Counties Soc., 5. ser., 14 (1919–20), pp. 132–134*).—The conclusions drawn from the trials here noted as continuing through one season only are that Bordeaux mixture, copper stearate, and possibly Burgundy mixture are equally effective in preventing attacks of scab on apples and pears, while a dormant spray of copper sulphate is less effective though not without value. Burgundy mixture causes serious injury to fruit and foliage.

The production of conidia in pure cultures by the brown-rot fungus of the apple, S. P. Wiltshire (*Univ. Bristol, Agr. and Hort. Research Sta. Ann. Rpt., 1919, pp. 34–36; also in Jour. Bath and West and South. Counties Soc., 5. ser., 14 (1919–20), pp. 123–126*).—In this investigation of the fungicidal action of sulphur compounds the spores of the brown-rot fungus (*Sclerotinia fructigena*) were used extensively for germination tests on account of their sensitiveness to sulphur, their large size, their ready germination in water, and the plentiful supply of material available throughout the summer. An outline is given of work undertaken for the purpose of developing a method of obtaining a satisfactory supply of spores.

The apple canker fungus, S. P. Wiltshire (*Univ. Bristol, Agr. and Hort. Research Sta. Ann. Rpt., 1919, pp. 23–29; also in Jour. Bath and West and South. Counties Soc., 5. ser., 14 (1919–20), pp. 113–120*).—Progress is reported as made during the year in the study of apple canker fungus, particularly as regards the culture of the apple canker organism (*Nectria ditissima*) in the laboratory and the spread of the disease under natural conditions. The germ tubes of the conidia growing under conditions of good aeration showed a negative heliotropism not so striking as in *Botrytis cinerea*, but quite definite. The exact means of infection is still under investigation. Preliminary control trials seem to show that any spraying experiments must be continued over a period sufficient to allow the full effect of the treatment to be estimated.

The relation of woolly aphis to apple canker was further studied. It appeared from experiments during 1919 that infection had taken place through the galls, especially the older galls, found toward the base of the year's growth. The fungus grew very vigorously in the gall tissue, which became very soft and disorganized, and the virulence of the disease was shown by the development of comparatively numerous pustules of conidia, even in the late autumn. It appears that infection may take place at this time through the wood elements exposed by the splitting of the aphis gall.

The die-back of red currants, S. P. Wiltshire (*Univ. Bristol, Agr. and Hort. Research Sta. Ann. Rpt., 1919, pp. 30–33; also in Jour. Bath and West and South. Counties Soc., 5. ser., 14 (1919–20), pp. 120–123*).—Sudden wilting and subsequent death of branches on red currant bushes caused considerable trouble at Long Ashton. Specimens showing similar trouble were obtained from other points, and some preliminary investigations have been made.

The first symptom of the disease was the sudden wilting of the leaves and fruit of one or more of the main branches. This wilting occurred at any time during the season, but was most noticeable in July, when the branches were laden with fruit almost ripe. Material obtained from Worcestershire, where the disease was also prevalent, showed a heavy infection by a fungus in the cortex, also in the wood. Somewhat extensive series of plate cultures resulted in the isolation of two types of fungi as the most probable agents of the disease, one of these apparently being identical with *Cytosporina ribis*. The second type of fungus produced quantities of conidia of the Fusarium type. Studies were begun with regard to *Nectria cinnabarina* in this connection.

[Localization of infection by Plasmopara (Peronospora) viticola and protection by spraying], F. Muth (*Ztschr. Pflanzenkrank., 26 (1916), No. 8, pp. 454–467, No 1*).—An account of attempts to determine the most advantageous and economical treatments for grape downy mildew concludes with the statement that in case of neglect and consequent infection of flowers and young grapes, through drenching with 0.5 per cent Bordeaux mixture from a revolving spray will save as much of the crop as can be saved by any treatment.

Exhibition of diseases of the Para rubber tree (*Nature [London], 105 (1920), No. 2629, pp. 86, 87*).—Attention is called to an important exhibition, illustrating the fungus diseases to which the Para rubber tree (*Hevea brasiliensis*) is subject in Ceylon and Malaya, which was opened on March 10, 1920, in the botany department of the Imperial College of Science and Technology. The exhibition, which was organized by J. B. Farmer of the college, included a large number of trunks of rubber trees, specially shipped from the East, showing the diseases as they occur in the plantation, and forms a striking commentary on the optimism which obtained in the first years of the industry as to the probable relative immunity of Hevea from disease.

The principal diseases represented in the collection include brown bast (bacterial?), *Fomes lignosus*, *F.* (*Poria*) *pseudoferreus*, dry rot (*Ustulina zonata*), patch canker (*Phytophthora faberi*), stripe canker (*Phytophthora* sp.), pink disease (*Corticium salmonicolor*), thread blight (*Cyphella heveae*), and die-back (*Botryodiplodia theobromae*).

ECONOMIC ZOOLOGY—ENTOMOLOGY.

Instructions for bird banding, F. C. Lincoln (*U. S. Dept. Agr., Dept. Circ. 170 (1921), pp. 19, figs. 12*).—In 1920 the work conducted by the American Bird Banding Association, organized in December, 1909, in continuation of several local attempts, was taken over by the Bureau of Biological Survey. In view of the valuable information to be secured relative to the movements and life histories of migratory birds, especially the game and insectivorous species, it is the plan of the bureau to advance this method of research along two principal lines: (1) The banding of fledglings as formerly practiced, and (2) the systematic trapping and banding of adults. The present circular gives directions for carrying on the work, including plans for the construction of traps, directions for their operation, methods of handling, attaching bands to birds, etc. The problems that can be solved by bird banding are summarized.

Twentieth report of the State entomologist for 1920, W. E. Britton (*Connecticut State Sta. Bul., 226 (1921), pp. 135–216, pls. 12, fig. 43*).—The inspection of imported nursery stock and of apiaries, first reported upon, is followed by a detailed Report of Work in Suppressing Gipsy and Brown-tail Moths, by W. E. Britton, I. W. Davis, and J. T. Ashworth (pp. 151–168), which includes a review of the status of the gipsy moth parasites and predators in the State. No new towns were found infested with the gipsy moth, and no trace of it was found in seven of the towns that were infested a few years ago.

Experiments in Dusting in Comparison with Spraying to Control Apple Insects (pp. 168–177) indicate that it is possible to hold the chewing insects in fairly satisfactory control by the use of the dust treatment. "With the addition of nicotin solution some of the sucking insects, particularly false red bug, seem to have been checked, but the data are too meager upon which to base conclusions. The nicotin makes the dusting mixture very much more expensive. The chief advantage of dusting over spraying is in the saving of time and labor. The disadvantage is in the cost of the materials, and apparently this more than offsets the saving in time and labor, as the approximate cost of one treatment per tree was fully three times as great for dusting as for spraying. If varieties are grown which are not susceptible to scab, and if sucking insects are not troublesome, dusting may give good results, but if these pests are serious in the orchard, better control will probably be obtained by spraying—a method which has been in common practice long enough so that we know its possibilities."

Notes on the Life History of the False Apple Red Bug in Connecticut, *Lygidea mendax* Reu. (pp. 177–179); Notes on the Life History of a Sawfly Feeding on Austrian Pine, *Itycorsia zappei* Roh. (pp. 179–182); and Tests of Soap Sprays to Kill the Pink and Green Potato Aphid, *Macrosiphum solanifolii* Ashm. (pp. 182, 183), all by M. P. Zappe, are next presented. In tests of soap sprays on the green potato aphid a soft soap intended for use in washing automobiles, made with a linseed oil base and containing only 56.2 per cent water, was employed. This soap, which cost 25 cts. per pound wholesale in 24 lb. pails, when used at the rate of 0.5 oz. to 1 gal. of water, was 100 per cent effective in killing the aphids on dipped potato plants. Part of a field of potatoes was also sprayed with it with very good results. Two other brands of soap used were less effective.

The European Red Mite, A New Orchard Pest in Connecticut, *Paratetranychus pilosus* Can. and Fanz., is next reported upon by P. Garman (pp. 184–189). Observations indicate that this mite has been in Connecticut at least three years, having been found at Greenwich, Danbury, Milford, Branford, Wallingford, Middletown, and Meriden. It has also been reported from Ontario and Pennsylvania, and is thought to occur in New Jersey. This mite passes the winter in the egg stage on twigs, in crevices in the bark, etc., in the orchard, and is a source of injury to the leaves. Injury was seen on Baldwin, Ben Davis, McIntosh, and Hurlburt, but in nearly every case the Baldwin showed the effects of infestation more than other varieties. Tests of various insecticides are reported upon in tabular form. Orchard experiments showed that attention must be given to early sprays, especially the delayed dormant application. This spray, apparently, should not be diluted more than 1:9, in the case of lime sulphur, and should be applied with great care to cover as much of the tree as possible.

The Apple and Thorn Skeletonizer in Connecticut, *Hemerophila pariana* Cler. (pp. 190–193), which pest has recently become established in the United States (E. S. R., 38, p. 60), was discovered in the fall of 1920 to occur in the towns of Greenwich and Stamford. The Sinuate Pear-tree Borer (pp. 193–196) is a source of considerable injury in pear orchards in Stamford and Greenwich, the Bartlett seeming to be the preferred variety. Brief summarized accounts are also given of The European Corn Borer (pp. 196–198); The Pear and Cherry Slug, *Caliroa cerasi* L. (pp. 199–201); The Currant Stem Girdler, *Janus integer* Nor. (pp. 201–204); The Celery Caterpillar or Fennel Worm, *Papilio polyxenes* Fab. (pp. 204–206); and The Grape Berry Moth (pp. 206, 207). An account is given of Mosquito Work, Season of 1920, by S. T. Sealy (pp. 208–210), and the report concludes with Miscellaneous Insect Notes (pp. 210–215).

[Report of the department of] entomology (*Indiana Sta. Rpt. 1920, pp. 22, 23, figs. 2*).—Investigations are said to have led to the conclusion that there are no well-defined broods of the codling moth in the State, but that from the time of emergence of the first moths, the first week in May, there is practically no break to the first of September following, the latter date depending upon the weather conditions. It is pointed out that this will necessitate the revision of spray schedules, and that the spraying schedule must be effective and thorough from the beginning to the end of the season in order to give satisfactory control.

During the year an unusual poultry mite, *Lyponyssus silviarum*, made its appearance in one of the houses of the poultry department, which led to tests of 40 different combinations of materials for its control. Dusting with sulphur proved quite satisfactory. In fumigation experiments it was found that nitrobenzol could be successfully used for killing the mites without injuring the fowls, but with the egg-laying hens the fumes inhaled affected the unlaid eggs to such an extent that they could not be used for domestic purposes.

Report of the entomologist, C. E. Wilson (*Virgin Islands Sta. Rpt. 1920, pp. 20–34*).—During the year 1920 a careful study was made of scale insects and their host plants in the Virgin Islands. This is reported in tabular form, the scientific name, common name, host plants, and occurrence on each of the three main islands being given for each species, of which 46 are recorded.

An improved insecticide emulsion, which will keep indefinitely in the concentrated form without separation of kerosene and which will also keep in the form of emulsion for a long period when diluted, first described by the agronomist in his report for 1915 (E. S. R., 36, p. 252), was used with success in the control of Coccidae and other insects. It is made by dissolving 4.5 lbs. of whale-oil soap in 1,000 cc. of fusel oil, to which 8,000 cc. of kerosene is added and the whole vigorously stirred until thoroughly emulsified. The stock solution may be diluted at the rate of 1 to from 10 to 20 parts of water.

The widespread and constant increase in numbers of *Aleurodicus cocois* and *Aleurothrixus floccossus* led to the introduction of the red fungus (*Aschersonia aleyrodis*) as a control measure. Due to unfavorable conditions at the time, this fungus failed to become established.

Investigations of sugar-cane insects have shown infestation by the sugar-cane borer (*Diatraea saccharalis*), the weevil cane borer (*Metamasius sericeus*), the cerambycid cane borer (*Lagochirus araneiformis*), mealy bugs (*Pseudococcus sacchari* and *P. calceolariae*), scale insects (*Targionia sacchari*), root grubs (*Ligyrus* sp. and *Strataegus titanus*), and shot-hole borer (*Xyleborus* sp). The borers *M. sericeus* and *L. araneiformis* caused the most injury, 15 per cent of the cane on the station grounds being damaged by them during the year. It is estimated that their ravages resulted in the loss of more than 2,000,000 lbs. of sugar during the year.

Cotton was found to be attacked by the cotton aphis, cotton worm, bollworm, green stink bug (*Nezara viridula*), the cotton stainer (*Dysdercus andreae*), the leaf blister mite (*Eriophyes gossypii*), the West Indian peach scale (*Aulacaspis pentagona*), the hemispherical scale, and the black scale.

Corn and Hopi maize suffered severely from insects during the year. Young corn plants in St. Croix were severely damaged by the corn leafhopper (*Dicranotropis maidis*), while very few were found on the Hopi maize. Other insects mentioned are the bollworm, which injured Hopi maize even more than corn; the sugar cane borer, which attacked both; and the corn aphis (*Aphis maidis*), which occasionally appeared on young corn and was largely kept in control by parasitic and predacious insects.

The West Indian sweet-potato weevil (*Euscepes batatae*) is the most serious enemy of sweet potatoes in the Virgin Islands. Its injury, which was 90 per cent on untreated vines, was reduced about 75 per cent by dipping in kerosene-fusel oil emulsion, as mentioned above. Its injury to late-planted vines was reduced about 60 or 65 per cent, untreated check vines having shown about 98 per cent infestation.

Two species of white flies were noted, namely, *Aleurodicus cocois*, which was found attacking the leaves of almond, banana, calabash, coconut palm and other palms, and *Ficus elastica*, and *Aleurothrixus floccossus*, which was found attacking guava.

Notes on the occurrence of and means of control for a number of other insects of importance during the year are also presented. The pests thus noted include the cattle tick, which was found every month on cattle; the fig borer (*Batocera rubus*), which did severe damage to fig and mango trees; mosquitoes, of which *Aedes calopus*, *Anopheles albimanus*, and *Culex quinquefasciatus* were the only species collected in St. Croix; *Corythuca gossypii* and the West Indian white peach scale (*Aulacaspis pentagona*), found infesting castor beans; slugs (*Veronicella occidentalis*), reported as doing severe damage to all vegetables in St. Thomas; the green stink bug, which in some cases rendered 50 per cent of the green pods of beans unfit for use; the bean leafroller; the southern beet webworm (*Pachyzancla bipunctalis*); the diamond-back moth; the southern cabbage butterfly (*Pontia monuste*); the cabbage aphis; the melon caterpillar; and a number of other pests found injuring eggplants, okra, tomatoes, and stored grain and grain products.

Effects of nicotin sulphate as an ovicide and larvicide on the codling moth and three other insects, N. E. McIndoo, F. L. Simanton, H. K. Plank, and R. J. Fiske (*U. S. Dept. Agr. Bul 938 (1921), pp. 19*).—This bulletin is based upon experiments conducted in the laboratory at Washington and in three important apple regions of the United States, namely, the Lake region at Benton Harbor, Mich., the mountainous region at Grand Junction, Colo.; and the semiarid region at Roswell, N. Mex. The first part of the report consists of experiments conducted in the laboratory concerning the effects of nicotin sulphate as an ovicide and larvicide on the codling moth, silkworms, Colorado potato beetle, and the white-marked tussock moth (pp. 2–15). This is followed by experiments conducted with a view to determining the effectiveness of nicotin sulphate as compared with the efficiency of arsenate of lead for controlling the codling moth in orchards.

In the laboratory nicotin sulphate, with one exception, was found inefficient against all of the eggs tested. "About 20 per cent of the freshly laid eggs sprayed with a solution of nicotin sulphate 1: 800 failed to hatch and one-third of the remaining embryos that emerged died before they entered pears sprayed a week previously. Hence about one-half of the eggs and larvae had been destroyed up to the time when the remaining larvae entered the sprayed pears; a large percentage of the latter larvae died, as about 60 per cent of the pears did not become wormy. According to these laboratory results, nicotin sulphate does not seem to be efficient against the codling moth, although only one application of it was made; nevertheless its effectiveness would certainly be increased in proportion to the number of its applications and to the amount of rainfall."

The conclusions drawn from field experiments are as follows: "According to the work conducted during the season of 1917, it is shown that nicotin sulphate 1: 800 with soap gave a fair degree of control for the codling moth at Benton Harbor, Mich., and at Roswell, N. Mex., but that it was not as effective as 1 lb. of powdered arsenate of lead to 50 gal. of water; and also that there was no practical advantage in combining arsenate of lead and nicotin sulphate in sprays designed to control the codling moth. Of course, it is well known that nicotin sulphate controls aphids on fruit trees, but this phase of the subject is not considered in this paper. At Grand Junction, Colo., where the infestation was much heavier, nicotin sulphate 1: 800 without soap was inefficient against the codling moth."

Experiments with grasshopper baits, J. R. Parker and H. L. Seamans (*Jour. Econ. Ent., 14 (1921), No. 1, pp. 138–141*).—This is a brief report of preliminary experiments conducted in Montana during the summer of 1919 for the purpose of improving the efficiency and reducing the cost of the poison bran mash commonly used for grasshoppers, special attention being given to finding substitutes for lemons and oranges. A brief reference to this work is made by Cooley in a report previously noted (E. S. R., 44, p. 348).

Amyl acetate was found to be not only the most attractive of the materials tested but also the cheapest of those that ranked high in attractiveness, an ounce, costing 5 cts., being equal to 8 lemons or oranges. Vanilla ranked second in the list of attractive materials and with amyl acetate was far better than any of the other materials tried, although its present cost prevents its use. Of the fresh fruits, watermelon gave the best results, but it was not nearly as attractive as amyl acetate or vanilla and but little better than salt alone. Salt alone was found to give as good results as molasses and salt, and both gave better results than when lemons or oranges were added. Oranges ranked fifth in the list of 12 attractive elements used, and lemons ranked tenth in order.

It is pointed out that these tests were conducted with adults of only one species, namely, *Camnula pellucida* Scudd., which had gathered in great numbers for breeding and egg laying.

Chinch-bug resistance shown by certain varieties of corn, W. P. FLINT (*Jour. Econ. Ent., 14 (1921), No. 1, pp. 83–85*).—In comparative tests in counties in Illinois heavily infested with chinch bugs, where a number of varieties of corn had been used, that known as White Democrat was markedly resistant when grown on fertile soil. The higher yield in this and several other varieties seems to be entirely due to their power to resist chinch-bug attack, since there was no difference in the number of chinch bugs present.

The potato leafhopper and tarnished plant bug in 1916, S. MARCOVITCH (*Jour. Econ. Ent., 14 (1921), No. 1, pp. 61, 62, pl. 1*).—This is a report upon observations made in Minnesota.

Further notes on the life history of the potato leafhopper (Empoasca mali Le B.), A. HARTZELL (*Jour. Econ. Ent., 14 (1921), No. 1, pp. 62–68, fig. 1*).—This is a report of studies of the life history of *E. mali* made at the Iowa Experiment Station during the season of 1920, in continuation of those previously noted (E. S. R., 44, p. 549).

The influence of leafhopper control on potato yields, J. R. EYER (*Jour. Econ. Ent., 14 (1921), No. 1, pp. 69–71*).—The author reports briefly upon comparative tests of different insecticide and fungicide combinations, made during 1919 and 1920, which lead him to question the economy of attempting the control of hopper burn in regions where there is comparatively little sunshine during the growing season.

Progress report on the season's work on the production of potato tipburn, F. A. FENTON (*Jour. Econ. Ent., 14 (1921), No. 1, pp. 71–83, figs. 2*).—Tests were conducted during 1920 to determine the effect of artificial mutilation on the potato leaf, the result of colonizing leafhoppers (*Empoasca mali* LeB.) on the plant foliage under different environmental conditions, the comparative effect of different stages of the insect on the leaves, the injury other insects might produce, and the effect of Bordeaux mixture on the leafhoppers.

"Tipburn or hopperburn of the potato is produced through the agency of *E. mali*. All nymphal stages of the leafhopper are capable of producing symptoms of the disease. The older the nymphs the greater the amount of injury done, nymphs in the first and second instars being incapable of producing any effect on the leaf unless in numbers. The greater the number of nymphs on a leaf the sooner the injury develops and the more rapidly the leaf or plant is killed. The adult hopper is not nearly so effective as any of the nymphal stages but will produce the disease when concentrated in large numbers on a given plant.

"The disease is produced to the same extent and just as soon under such diverse environmental conditions as type of soil, amount of moisture in the soil, presence or absence of sunlight, or reduced leaf transpiration. Tipburn as a disease is localized, being confined to that part of the plant exposed to the attack of the leafhoppers, whether this be a leaflet or entire branch.

"Other insects known to feed on potato, such as Buffalo treehopper nymphs, tarnished plant bugs, potato aphis, and flea beetles, produce a type of injury characteristic of the individual species concerned but in no way resembling tipburn.

"Bordeaux mixture prevents tipburn by repelling the ovipositing female leafhoppers."

The corn leaf aphis (Aphis maidis Fitch) in Kansas, J. W. MCCOLLOCH (*Jour. Econ. Ent., 14 (1921), No. 1, pp. 89–94, pls. 2*).—This is a report of observations made at the Kansas Experiment Station of the more important types of injury, and of certain experiments which indicate possible means for the reduction of the injury. The author finds that in Kansas *A. maidis* is a pest of the various sorghum crops, as well as of corn.

The satin moth, an introduced enemy of poplars and willows, A. F. Burgess (*U. S. Dept. Agr., Dept. Circ. 167 (1921), pp. 16, figs. 7*).—The satin moth (*Stilpnotia salicis* L.), a well-known European pest, was first reported from the United States about July 1, 1920, as defoliating Carolina poplars (E. S. R., 44, p. 252). A survey made of the infestations show an area of 642 square miles, including 60 towns in Massachusetts and 4 in New Hampshire, to have been infested by it during 1920. The pest is thought to have been in this country for several years but only became abundant enough to spread very rapidly during the past two or three years, the worst infestation being in the area along the Fellsway at the Medford-Malden, Mass., line.

Its name is taken from the white, satin-like appearance of the moths, which are larger than most of the white moths native to New England and have no colored markings on the wings. The eggs are laid in somewhat elongated patches, 13 to 22 mm. in length, and covered with a white secretion which holds them together in the cluster, which is very conspicuous and easily distinguished from the egg masses of other moths. Dissections show that a female produces about 550 eggs, which are usually laid on the underside of the leaves and on the branches and trunks of the trees, though they are sometimes deposited on grass, weeds, or stones, and even on the ground if no more convenient place is available. In 1920 the first eggs were observed in the field July 6, and an unhatched cluster was found as late as August 10. Hatching takes place about 15 days after oviposition, though the period is frequently shorter if the weather is hot.

In the first two larval stages molting takes place after 5 or 6 days. Arriving at the third stage the larvae immediately seek shelter and begin the construction of a small web, in which they hibernate. Crevices or uneven places in the bark are sought by the larvae, and if the cavity is not sufficiently deep a small amount of bark is excavated. The cavity is then lined with silk, and the larva spins a cover over the entrance. While probably most of the larvae remain in the pockets during the winter, a few cases have been noted where they have deserted them temporarily during the fall.

The feeding of the small caterpillars is confined to the epidermis of both sides of the leaves, and if the infestation is severe, most of the foliage on the trees may be denuded so that only the ribs and framework remain. Since most of this feeding occurs during the first half of August, many of the leaves that are only partially eaten turn brown and drop earlier than normal. "Observations in the field during 1920 indicated that feeding by the small larvæ was confined principally to different species of poplar, the Carolina, Lombardy, Balm of Gilead, and silver leaf showing the most defoliation. In the laboratory experiments willow was equally favored, but the small larvae starved rather than feed on alder, apple, gray birch, elm, red oak, and white oak."

Emergence in the spring has not been observed in this country, but the larvae probably come out of the webs and begin feeding as soon as sufficient foliage is available. After passing through several molts they become full grown by about July 1. When full grown the larvae are 45 to 50 mm. long, with a bluish-black head covered with short hairs and a black body mottled with white markings of irregular shape. After feeding is completed the larvae seek shelter and spin loose cocoons, many of which are made by drawing together the edges of leaves on the trees. They are sometimes made in crevices in the bark, in rubbish near the base of trees, or on the sides of buildings. Pupation in 1920 was at the maximum by July 6, the time spent in the pupal stage averaging 9 days. The first moth was found on July 2, and for the next two weeks the number increased.

The species is common in England and Ireland, and throughout Europe, its range extending from Spain to Eastern Asia and as far north as Norway, and it is said to be present in the Orient.

In Europe it is usually controlled by parasites and other natural enemies and is not considered a pest of first rank. Of the numerous parasites which attack it, a number are already well established in the infested area in New England. Field observations show *Calosoma sycophanta* L. to be one of the valuable insects that attack the larvae and pupae, and *Compsilura concinnata* Meig. was found to heavily parasitize the large larvae. *Telenomus californicus* Ashm. has been reared from the eggs. Control measures consist in the application of creosote to the egg clusters and in the use of arsenate of lead in the spring, as soon as the trees are in full leaf, at the rate of 10 lbs. to 100 gals. of water, using soft soap for a sticker, to be repeated in the middle of June and again about August 1 if necessary.

The pea moth in Wisconsin, C. L. Fluke, jr. (*Jour. Econ. Ent., 14 (1921), No. 1, pp. 94–98*).—This is a summary of studies of *Laspeyresia novimundi* Heinr. conducted by the author, a bulletin on which has been noted (E. S. R., 43, p. 257).

European corn borer in New York State, E. P. Felt (*Jour. Econ. Ent., 14 (1921), No. 1, pp. 85–89*).—This is a brief account of the status of this pest in New York.

Biology of the smartweed borer, Pyrausta ainsliei Heinr., G. G. Ainslie and W. B. Cartwright (*Jour. Agr. Research [U. S.], 20 (1921), No. 11, pp. 837–844*).—This is a report of observations of *P. ainsliei*, which first came to the attention of the senior author in 1912, when hibernating larvae were found in cornstalks at Franklin, Tenn. It is pointed out that until recently the species, which was first described by Heinrich in 1919 (E. S. R., 42, p. 361), has been confused with a similar species, *P. penitalis* Grote, which feeds on lotus. A summary of information on smartweed and lotus borers by Chittenden, in 1918, has been noted (E. S. R., 40, p. 756).

The smartweed borer is known to occur in Massachusetts, New York, Pennsylvania, Ohio, and Illinois, and has been taken by the author at numerous points in Tennessee and Kentucky, and at Clemson College, S. C. Since its principal food plant, *Polygonum pennsylvanicum*, occurs throughout the eastern half of the United States, it is thought likely that the distribution of the borer is coextensive with it.

It is pointed out that the plants on which larvae are found include food plants proper and also shelter plants. While several species of the genus Polygonum have been recorded as food plants of the larvae, the authors' observations indicate very clearly that south of the Ohio River, at least, it breeds only in *P. pennsylvanicum*. The species has been reared from eggs to full-size caterpillars on leaves of curled dock (*Rumex crispus*) and buckwheat (*Fagopyrum fagopyrum*), both of which are close relatives of Polygonum, but the larvae have never been found on these plants in the field. On the leaves of lotus (*Nelumbo lutea*), which is the host plant of *P. penitalis*, the larvae in several experiments have starved to death after merely pitting the leaf surface, and the statement of Heinrich (E. S. R., 42, p. 361) that the authors have reared larvae to maturity on *N. lutea* is said to be an error. Shelter plants include all plants the stems of which are entered by larvae seeking winter quarters, of which a number, including corn, are recorded.

" In Tennessee there are two generations of the smartweed borer each year.

well-defined periods of maximum abundance, the first from June 20 to July 5 and the second from August 18 to 30. Moths emerging in June at once oviposit, and the resulting larvae complete their growth early in August and immediately pupate in their larval burrows in the smartweed stems. The moths emerge later in the same month and give rise to the second generation of larvae, which reach full growth before winter and without further feeding remain in the food or shelter plants unchanged until they pupate in May and June of the following year."

In a reared series of larvae from eggs hatching August 16 a number of moths emerged October 13 and 15. The eggs have been taken many times by the authors in the field, but oviposition has not been observed. They are laid in small patches or often in rows, with the individual eggs overlapping shingle fashion, on the underside of the leaves. The number of eggs per mass varied from 4 to 16, with an average of 9.3, in a collection of 30 egg masses and from 7 to 14, with an average of 9.47 per mass, in a collection of 17 egg masses. The incubation period from June to July was 6 days and in late August 5 days.

Upon hatching, the young larvae at once enter the stem near the tip of a branch, choosing the base of a petiole for their point of attack. That they are somewhat gregarious at this stage is shown by the fact that all the larvae hatching from one egg mass usually enter the stem at the same point, which may be several inches from the egg mass. Larvae of the first generation make no effort to leave the smartweed stems but pupate in them as soon as fully fed. Those of the second generation attack the plants in the same way and feed as did their progenitors until they are fully grown. This stage is reached about the last of August, and thereupon many of the larvae abandon their host plant and seek shelter elsewhere.

The species varies greatly in abundance from year to year. This in Tennessee, at least, appears to be due to the variation in the abundance of its parasites, of which the most important is the tachinid (*Panzeria*) *Pyraustomyia penitalis* Coq. Over 40 per cent of the larvae taken in the field at Knoxville for rearing are said to have been killed by this parasite. The flies that have been reared by the authors have emerged during two distinct periods, from May 30 to June 10 and from August 18 to September 12, coinciding closely with the normal dates for the emergence of the adults. This is thought to indicate that the flies attack the host larvae during their early instars. Three other tachinid flies are said to have been reared from *P. penitalis*, namely, *Exorista vulgaris* Fall., *Hypostena variabilis* Coq., and *Phorocera comstocki* Will., and three apparently distinct hymenopterous parasites, by the authors.

Report on investigations of the pink bollworm of cotton in Mexico, U. C. Loftin, K. B. McKinney, and W. K. Hanson (*U. S. Dept. Agr. Bul. 918 (1921), pp. 64, pls. 5, figs. 11*).—The present report is based upon two years' work conducted in Ciudad Lerdo, Durango, Mexico, near Torreon, the so-called Laguna district, by the Federal Horticultural Board. The report deals with the distribution of the pink bollworm (*Pectinophora gossypiella* Saund.), its life history, seasonal history, feeding habits of the larvae, damage caused, food plants, dispersal, natural control, and repression.

This pest was introduced into Mexico in 1911 with seed for planting, and five years later was generally and uniformly distributed throughout the Laguna and had reached its maximum development. Infestation starts in the spring as soon as squares are formed, by moths emerging from hibernating larvae, and rapidly increases until practically every boll is infested with several larvae by fall. Its life cycle was found to be completed in an average of 31 days in the summer, but the larval stage of hibernating or resting larvae may be extended for two years or more.

"Dispersal is mainly through the carriage by man of hibernating larvae in seed, but local dispersion is brought about also by flight and carriage of adults. The pink bollworm causes approximately 25 per cent gross damage to the Laguna crop by feeding in the bolls and squares. This feeding results in a reduction in the quantity and quality of the lint produced, reduction in the quantity of seed, and lowering of the quantity and quality of the oil content of the seed. Early cleaning of fields by burning all the old stalks and bolls, cleaning and fumigation of gins, oil mills, and seed warehouses, the fumigation of all seed kept on the plantations, and the early maturity of the crop are recommended as means of control."

A list is given of 12 references to the literature cited, and a description of the pink bollworm, by Busck, in a paper previously noted (E. S. R., 37, p. 564) is reprinted in an appendix. An account of this pest by Hunter has been noted (E. S. R., 39, p. 764).

Some Lepidoptera likely to be confused with the pink bollworm, C. HEINRICH (*Jour. Agr. Research* [*U. S.*], *20* (*1921*), *No. 11, pp. 807–836, pls. 17*).—This is a report of studies conducted for the purpose of defining the characters by which the larva and pupa of the pink bollworm (*Pectinophora gossypiella* Saund.) can be distinguished from those of other Lepidoptera attacking cotton or related malvaceous plants and from those feeding on plants other than malvaceous but frequently found in the neighborhood of cotton fields.

It is pointed out that a few species, including *Dicymolomia julianalis* Wlk. and *Crocidosema plebeiana* Zel., so closely resemble the pink bollworm in their habits and their larval stages that they can only be distinguished by a careful examination of their structure. The field work upon which this paper is based was conducted throughout the area in southeastern Texas where the pink bollworm has been found to occur, and in Cameron County at the southern extremity of the State. In the present paper 38 species are considered, of which six, namely, *Gelechia neotrophella*, *Telphusa mariona*, *Borkhausenia diveni*, *Holcocera confamulella*, *Eucosma discretivana*, and *Phalonia cephalanthana* are described as new, and four, previously described, are recorded from the United States for the first time.

Experiments with contact sprays for leaf miners, W. C. O'KANE and C. A. WEIGEL (*New Hampshire Sta. Tech. Bul. 17* (*1921*), *pp. 24, figs. 5*).—The experiments here reported were commenced in the laboratories at Durham, N. H., in the early summer of 1917 and were continued in near-by orchards, with additional studies at Columbus, Ohio. The work was carried on with apple foliage infested with the apple leaf trumpet miner, with foliage of marguerites infested with the marguerite fly (*Phytomyza chrysanthemi*), and with quince leaves infested by miners. The results of the studies have been summarized as follows:

"Preliminary laboratory experiments gave inconclusive results as to penetration of sprays into leaf mines in the species observed, except adjacent to points where there was an opening to the surface.

"Studies of the apple leaf trumpet miner under orchard conditions gave the following results: The expectation of normal position of the larva in the mine from 2,645 observations was for mature larvae, first generation, 10+ per cent at small end of mine, 71+ per cent at center, 18+ per cent at large end; for young larvae, second generation, 53+ per cent at small end, 30+ per cent at center, 16+ per cent at large end. The expectation of normal dead was for mature larvae, first generation, 6.79 per cent; for young larvae, second generation, 7.01 per cent. The position of dead larvae from all treatments corresponded approximately to the position of normal larvae. Records of larvae from sprayed foliage, tabulated according to size of larva, showed maximum mortality of 41 per cent in smallest larvae, this mortality diminishing steadily to a minimum of 13 per cent in larvae of next to largest size. No casual relationship was discovered between position of larva in mine and mortality. The more mature larvae were found more frequently in the smaller end of the mine, and the younger larvae were found more frequently in the larger end of the mine. A study of progressive mortality following spraying showed an apparently considerable mortality at the end of 24 hours, a diminished mortality at the end of 48 and 72 hours, and a marked increased mortality at the end of 7 days. None of the sprays used gave any considerable efficiency with mature larvae of the apple leaf trumpet miner, first generation; nicotin sprays at the stronger dilutions and, to a less extent, kerosene emulsion 1:8 gave net efficiency ranging from 73 to 37 per cent with the young larvae, second generation.

"Experiments with the same materials on quince leaf miner (omitting kerosene emulsion) gave a mortality ranging from 14 to 100 per cent, the heavier mortalities predominating. Experiments with highly concentrated insecticides on mines containing pupating larvae and pupae of the apple leaf trumpet miner gave a maximum mortality of 83 per cent, but in most cases a mortality of less than 50 per cent. Contact sprays applied to foliage bearing eggs of the apple leaf trumpet miner gave mortalities ranging from 89 to 100 per cent in the case of all nicotin sprays and in the case of lime sulphur solution. Kerosene emulsion gave a maximum mortality of 7+ per cent. Sprays applied for the first generation of the apple leaf trumpet miner gave definite residual effects on the eggs of the second generation, laid two to three weeks later, the mortality on foliage that had been sprayed with nicotin sprays at the less dilutions ranging from 70 to 90 per cent, as compared with a normal mortality of 22 per cent. Lime sulphur and kerosene emulsion gave no apparent residual effects. Chemical tests intended to detect the presence of sprays eight days after application in somewhat rainy weather gave negative results. Further tests under somewhat different weather conditions gave positive reactions at the end of 5 days, occasional reactions at the end of 8 days, and rarely at the end of 11 days."

Hessian fly prevention, H. A. Gossard and T. H. Parks (*Jour. Econ. Ent., 14 (1921), No. 1, pp. 53–60*).—This is a discussion of work in Ohio during the years 1919 and 1920, which has led to the following conclusions:

"A well-organized extension service cooperating with the county farm bureaus can get the recommended dates for seeding into the hands of the farmers within 24 hours or less after they are determined from the emergence records. And, further, by energetic preliminary work, the extension entomologist can secure the ready cooperation of 99 per cent of the farmers in a seeding campaign. . . . As a result of our annual surveys and correlated efforts, a threatened heavy brood of fly has been kept suppressed, and there will be twice as many bushels of wheat in Ohio in 1921 as would have been the case had we given the insect no attention."

The beet leaf-beetle and its control, F. H. Chittenden (*U. S. Dept. Agr., Farmers' Bul. 1193 (1921), pp. 8, figs. 7*).—This is a summary of information on *Monoxia puncticollis* Say, the larva and, to a lesser extent, the adult of which, in the Rocky Mountain States, injure the foliage, especially of young sugar beets, and also attack table beets of all kinds and spinach. The present paper gives more detailed information than the earlier account (E. S. R., 15, p. 692).

This species occurs along the Atlantic seaboard from Massachusetts to Florida, in California near the seacoast, and in the alkaline regions of Colorado, Utah, New Mexico, Arizona, Idaho, and Montana, as well as in portions of Kansas and Texas. The maritime forms occurring along the Atlantic and Pacific coasts do not cause injury and may be distinct geographical races. The adults feed on sugar beets, garden or table beets, mangel-wurzel, Swiss chard, spinach, lamb's-quarters, seablite, Russian thistle, saltwort, saltbush, sea-purslane, and pigweed. The larvae feed on sea-blite, lamb's-quarters, Russian thistle, and sugar beets only. The adults cut large, irregular holes through the leaves of the sugar beet, and the larvae do similar injury, eating pits in the leaves, frequently without cutting through. They also act as carriers of the spores of beet leaf-spot.

In the Arkansas Valley in Colorado there are two generations and a partial third each year. The beetles pass the winter on the surface of the ground in alkali areas under tufts of grass, etc. They issue from winter quarters in March and April and deposit their eggs. The first generation of beetles from these eggs, in Colorado, appears late in May or early in June, and the second generation becomes mature during the latter part of July. The eggs hatch in from 8 to 18 days, the larvæ feeding from 3 to 4 weeks. When mature, the larvæ burrow into the soil to a distance of 0.5 to 2 in. and form cells in which, in 8 or 9 days, they transform to pupae and then to adults.

Control measures consist in burning the grass, weeds, etc., in which they hibernate, and their control is furthered by use of trap heaps of weeds, etc., which are later burned. In tests made with arsenicals and other insecticides neither dusting nor spraying has proved entirely effective.

The Mexican bean beetle, a new pest in Alabama, W. E. Hinds (*Alabama Col. Sta. Bul. 216 (1921), pp. 11–18, pls. 4, fig. 1*).—This is a popular summary of information on *Epilachna corrupta* Muls., which is thought to have been introduced into Alabama in carload shipments of alfalfa hay, and by November, 1920, had spread into all or parts of 13 counties centering around Birmingham, Ala., the known infestation at that date covering at least 4,500 square miles. Earlier accounts, by the author, of its occurrence in Alabama have been noted (E. S. R., 45, p. 55).

In Alabama it attacks all varieties of table beans, including all of the kidney beans, whether of the common snap or shell varieties, cornfield beans, California black-eyed peas and all other cowpeas, and soy beans. In the experience of Alabama bean growers the destruction of kidney bean crops (snap and shell beans) has commonly been complete after about the first of July, while only a part of the early spring crop has been secured and the late planting of beans has proved useless. Lima beans are usually less completely destroyed, and a partial crop may be secured. Pole and "cornfield" beans have been completely destroyed as a rule. It is thought the loss in the table bean crops may exceed 70 per cent. Crops of cowpeas and soy beans, while usually less severely injured thus far, have in some cases been riddled about as completely as the table beans, the reduction in the yield of cowpea hay having been as high as one-third of its normal weight and the loss in feeding value an even greater proportion. The winter is passed only in the adult stage, most of the beetles continuing to feed until frost has killed the foliage.

Quarantine measures have been applied to the known infested area and to an adjoining safety zone approximating 25 miles in width. No really effective and satisfactory measures of control are yet known. It is thought that the most effective methods of checking the bean beetle consist in the prevention of late fall breeding and the removal of favorable winter shelter. Control by application of arsenical poison to the foliage is not satisfactory (1) since the insects are mainly repelled instead of killed, (2) because of the difficulty of applying any insecticide so as to coat the undersurface of each leaf and reach their feeding places, (3) because of the rapid growth of the young bean plants before the injury becomes great, thus quickly providing fresh unpoisoned food areas, and (4) bean foliage is extremely tender and liable to burning by a treatment that might kill the insect.

Studies of this pest by Merrill, in New Mexico (E. S. R., 37, 465), and a bulletin by Chittenden and Marsh (E. S. R., 43, p. 455) have been noted.

A girdler on artichoke and other little-known insect pests, W. J. Baerg (*Jour. Econ. Ent., 14 (1921), No. 1, pp. 99, 100*).—The cerambycid *Mecas inornata* Say is said to girdle the main stem of the artichoke, in Arkansas, about 6 in. from the top at the time of oviposition. Caterpillars of *Haploa colona reversa* Stretch are said to have appeared on strawberries early in April in the neighborhood of Johnsons, Ark., about 10 per cent of the foliage being destroyed. *Eleodes tricostata* Say is said to have damaged strawberry plants in new beds.

[Papers on apiculture] (*Jour. Econ. Ent., 14 (1921), No. 1, pp. 101–137*).—The papers here presented, which were given at the meeting of the section on apiculture of the American Association of Economic Entomologists held at Chicago in 1920, are as follows: The Value of Good Queens, by F. B. Paddock (pp. 101–105); the Problem of Controlled Fertilization of Queen Bees, by L. V. France (pp. 105–110); Further Notes on the Value of Winter Protection for Bees, by J. H. Merrill (pp. 110–114); Some Beekeeping Problems for Experiment Stations, by F. C. Pellett (pp. 114–116); Stopping the Distribution of American Foul Brood at its Source, by S. B. Fracker (pp. 117–121); Legislation for Control of Foulbrood, by M. C. Tanquary (pp. 121–127); and Mixed Infection in the Brood Diseases of Bees, by A. P. Sturtevant (pp. 127–134).

Leconte's sawfly, an enemy of young pines, W. Middleton (*Jour. Agr. Research [U. S.], 20 (1921), No. 10, pp. 741–760, pls. 5, figs. 3*).—This paper summarizes the status of knowledge of the life and seasonal history of *Neodiprion lecontei* (Fitch), a sawfly originally described from specimens collected in New York, which occurs from southern New England south to Virginia and West Virginia and west to Michigan and northern Wisconsin, and has been collected in North Carolina and in southern Mississippi and Louisiana.

The first part of the paper consists of detailed descriptions of the life stages. The time between the deposition of the first egg and the emergence of the last adult is said to be approximately either 12 or 14 months. that is, 12 months when the eggs are laid in the late summer or early fall and 14 months when they are laid in the later spring or early summer. From the cocoons of a single colony there are two periods of adult emergence, the first of which is termed "brood A" and the second "brood B." When the colony period begins in late spring or early summer, brood A emerges in the late summer and early fall of the same year and brood B emerges in the late summer and early fall of the following year, making the length of the colony period 14 months. When the colony period begins in the late summer, brood A emerges in the spring and early summer of the following year and brood B emerges in the late summer and early fall of the following year, making the length of the colony period 12 months.

The eggs, which are laid in a row of slits along one of the serrated edges of the leaf, vary in number from 25 to 218. As a result of there being two periods of adult emergence there are two periods of oviposition and incubation during the year, coincident with those of issuance, the first occurring in the late spring and early summer, particularly May and June, and the second in the late summer and early fall (late July, August, and early September). The period of incubation as determined by the time elapsing between the laying of the first egg and the hatching of the first larva varies from 13 to 21 days, with an from six experiments of 16 days.

The length of the larval feeding period from hatching out to the appearance of the first prepupa varies from 25 to 31 days, with an average of 28 days. The approximate length of the first stage is 6 days, of the second, third, and fourth 5 days each, and of the fifth and sixth 4 days each. The larvae of the first three stages eat only the epidermis and the immediately adjoining tissue of the needles, but beginning with the fourth stage and continuing through the sixth, they eat the whole of the needle and occasionally portions of the tender bark of the young twigs. Following the larval feeding period comes the prepupal instar, a larval, nonfeeding, cocoon-spinning, quiescent stage. The length of the cocoon period, passed several inches beneath the surface of the ground, from its spinning to the issuance of the adult, varies with the character of the colony, the period between the first cocoon and the first adult from eggs laid in May or June ranging from 13 to 23 days in brood A and from 364 to 379 days in brood B.

This sawfly is said to appear and disappear periodically, being abundant for several years, then for a few years becoming rare. The jack pine (*Pinus banksiana*), the red pine (*P. resinous*), and the scrub pine (*P. virginiana*) are the primary or preferred hosts of the species, and ten species of Pinus and the American larch are mentioned as secondary or possible hosts.

No parasites have been reared from the egg or uncocooned larvæ, but four hymenopterous species, namely, *Exenterus diprioni* Roh., *Lagorotis diprioni* Roh., *L. virginiana* Roh., and *Perilampus hyalinus* Say, and four dipterous species, namely, *Phorocera claripennis* Macq., *Adomonita demylus* Wlk., *Neopales maera* V. d. Wp., and *Spathimeitenis spinigera* Town. A bacterial wilt disease of the larva was observed in Wisconsin in 1912. None of these parasites, nor the wilt disease, has been observed to be sufficiently abundant or effective to account for the periodical disappearance of the species.

"The species does considerable damage to both natural reproduction and nursery stock by defoliating the trees. Complete or nearly complete defoliation before late summer usually kills that part defoliated, and since this insect shows a very decided preference for young trees, and the larvae often are numerous enough to strip the tree entirely of leaves, many young pines are killed by this work alone. Trees not completely denuded often die because in their weakened condition they are attacked by secondary insect enemies. When there is incomplete defoliation and the tree recovers, it is often stunted or misshapen and is of little commercial or ornamental value." In nurseries and in parks, in case of heavy infestation, control can best be obtained by application of arsenate of lead at the rate of 2 lbs. of powder to 50 gal. of water. When less than 3/8 in. long, the larvae are said to be fairly well controlled by the use of nicotin sulphate.

A revision of the genus Fasciola, with particular reference to F. gigantica (Cobb.) and F. nyanzi (Leip.), H. G. Jackson (*Parasitology, 13 (1921), No. 1, pp. 48–56, pl. 1, figs. 4*).—Descriptions and a key for the separation of the species of Fasciola are given.

On the life history of Ascaris lumbricoides L., V, F. H. Stewart (*Parasitology, 13 (1921), No. 1, pp. 37–47, figs. 8*).—This is in continuation of papers previously noted (E. S. R., 42, p. 383).

After presenting a summary of the literature on the subject published during 1919 and 1920, experiments conducted by the author during 1920 are briefly reported upon. The anatomy of the larva of *A. suilla* Duj. found on the nineteenth day after hatching in the intestine of the pig and the development of certain organs in *A. suilla* from the embryo at hatching to the larva are described. The route taken by the larvae of *A. suilla* in their migration through invasion of Ascaris larvae, and the extent of natural Ascaris infestation of pigs in England and treatment suggested with a view to the eradication of the disease are dealt with.

An hereditary Rickettsia-like parasite of the bedbug (Cimex lectularius), J. A. Arkwright, E. E. Atkin, and A. Bacot (*Parasitology, 13 (1921), No. 1, 27–36, pl. 1, fig. 1*).—*Rickettsia lectularia*, a parasite of *C. lectularius*, is described as new.

FOODS—HUMAN NUTRITION.

Nutrition laboratory, F. G. Benedict (*Carnegie Inst. Wash. Yearbook, 19 (1920), pp. 267–276*).—This is the customary annual report of the nutrition laboratory of the Carnegie Institution (E. S. R., 43, p. 266). The additions to the equipment during the year include a static control recorder for testing the stability of a subject's coordination mechanism when standing with eyes closed. The apparatus employs four movement adders, each of which accumulates the amount of sway in one particular direction. A graphic record is also provided to serve as a check upon the quantitative data.

Brief reports are given of investigations in progress and abstracts of publications issued during the year.

The chemical composition of Texas honey and pecans, G. S. Fraps (*Texas Sta. Bul. 272 (1921), pp. 5–9*).—Analyses by the Official method are reported of 18 Texas honeys from various plants and 11 varieties of pecans. The average composition of the honeys was as follows: Protein 0.36, reducing sugars 75.71, sucrose 1.17, nonsugars 4.02, water 18.51, and ash 0.23 per cent and direct rotation—15.8. These averages are similar to the averages for American honey reported by Browne (E. S. R., 19, p. 1058).

The average composition of the pecan meats was as follows: Protein 10.66, fat 72.44, crude fiber 2.31, nitrogen-free extract 9.82, water 3.2, and ash 1.57 per cent. Analyses are also reported for four samples of pecan hulls. These are considered, however, to have no food value.

Relation of processing to the acidity of canned foods, W. D. Bigelow and P. H. Cathcart (*Natl. Canners Assoc. Bul. 17–L (1921), pp. 46, figs. 16*).—In this bulletin, which continues the series of studies dealing with the processing of canned foods (E. S. R., 44, p. 461), the results are presented of a systematic analysis of the acidity of a large number of canned foods in terms of H-ion concentration as determined by the hydrogen electrode method. The data are presented in tables including the description and source of the product, pH values, size of can, and time and temperature of processing.

The range of pH values of representative canned fruits extends from pH=2.9 for plums to pH=7 for lye hominy. Most fruits fall within the range of pH=3 to pH=4 and most vegetables between pH=5 and pH=6. Between pH=4 and 5 are found tomatoes, pimentos, and okra, between 6 and 7 peas and corn, and also salmon, shrimps, and tuna, the only fish products reported.

A comparison of the pH values and temperature of processing shows that, in general, the greater the H-ion concentration the lower the process necessary for sterilization. Among the factors causing exceptions to this rule are variations in heat penetration of different products and variations in preparation of the material, affording a greater or less opportunity for increase of bacteria.

To determine the changes in H-ion concentration during the period of processing, a number of typical products were given the usual preliminary treatment and processed in No. 2 cans for varying periods of time, thus enabling a comparison of pH values of the same kind of material at regular intervals. Fac[illegible] influencing pH values during processing as brought out in the results reported, are the heat of processing, which tends to increase the acidity of foods, particularly in the early stages of the process; the addition of water, sirup, or brine, tending to decrease the acidity; and diffusion, tending to increase the acidity in the case of foods canned alone or with the addition of water, sirup, or brine, and to decrease the acidity in cases of the addition of acid liquor as tomato sauce. The pH changes during the processing of a number of products are given to illustrate the influence of the above factors.

A brief explanation of pH values and H-ion concentration is appended.

Creatinin and creatin in the blood, C. C. Wang and M. L. Dentler (*Jour. Biol. Chem., 45 (1920), No. 1, pp. 237–243*).—Determinations by the method of Folin and Wu (E. S. R., 41, p. 13) of the creatinin and creatin content of the blood of 24 normal women in intramenstrual and menstrual periods are reported, with the following general results:

No regular variation for creatinin or creatin was found during menstruation. The range for creatinin was from 0.96 to 1.65 mg. per 100 cc. with an average value of 1.3 mg., which falls within the range of the figures obtained by previous investigators, chiefly on men subjects, and thus fails to substantiate the theory that blood creatinin is lower in women than in men. No relation was observed between the age of the subject and the amount of creatinin eliminated. The range for creatin was from 2.23 to 4.65 mg. per 100 cc., the results being slightly lower than those reported by other observers.

A study was also made of the influence of sugar on blood creatinin and creatin. The figures for creatinin were, with one exception, higher on the high than on the low sugar diet. The creatin readings were not so noticeably affected.

The food requirements of children.—I, Total caloric requirements, L. E. Holt and H. L. Fales (*Amer. Jour. Diseases Children, 21 (1921), No. 1, pp. 1–28, figs. 12*).—This is the first of a series of papers on the general subject of the food requirements of the child during the whole period of growth, the discussion in this paper being limited to the different factors which must be considered in the estimation of the total calories. The observations of various authors are reviewed and discussed, and original observations are reported on over 100 normal children of both sexes from 1 to 16 years of age.

The component parts of the total caloric requirements of children are considered to be the requirements for basal metabolism, growth, muscular activity, and the food values lost in the excreta. For the basal requirement the authors accept the values given by Benedict (E. S. R., 43, p. 166) as representing the irreducible minimum. The food value normally lost in the excreta, as estimated from the observations of various workers, is calculated as 10 per cent of the total calories for all except nursing infants who utilize a much higher percentage of the total food intake.

The requirements for growth have been estimated by multiplying 80 (the number of calories estimated by Rubner as needed daily to increase the weight of the body 1 kg. in one year) by the average increase in kilograms per annum. On this basis it is shown that the requirements for growth are greatest during the first years of life and during adolescence and are nearly uniform from the fourth to the tenth or eleventh year. The average of the requirements for basal metabolism, growth, and loss in excreta is shown to be nearly uniform for children of the same weight living under similar conditions, while the requirement for activity varies widely. It is the opinion of the authors that in many estimates of total caloric requirements for children this factor has not been taken into account sufficiently. It is also emphasized that underweight children require more calories per kilogram and overweight fewer calories than those of average weight. The tentative schedule of average caloric requirement is given as follows:

"The average caloric requirement of children according to our observations is about 100 calories per kilogram at an age of 1 year (about 9.5 kg.). For boys it falls to about 80 calories at 6 years (about 20 kg.) and remains practically constant at this value up to the age of 15 years, the increasing requirements for activity being met by the reduction in basal requirements per kilogram. After a weight of 50 kg. (about 15 years) is reached the calories per kilogram can rapidly be reduced to adult standards, about 48 calories per kilogram. The requirement for girls falls to 76 calories per kilogram at 6 years (about 20 kg.), continues at this value until the tenth year. During the tenth year it rises because the basal requirement is nearly constant while there is an increase in needs for growth and activity. The requirement remains at 80 calories per kilogram until growth is complete, then falls rapidly to adult standards, about 44 calories per kilogram."

In comparing this schedule with those proposed by others, the authors call attention to the fact that they have allowed a much higher value for calories per kilogram during adolescence than have others. This is thought to be absolutely essential because of the increased growth needs and the large requirement for muscular activity at this period.

The question of the practical significance of the nutritive value conception with remarks on the minimum fat requirements of infants, F. von Gröer (*Biochem. Ztschr., 97 (1919), No. 6, pp. 311–329*).—The author describes two cases from Von Pirquet's infant clinic in Vienna of infants who were apparently satisfactorily nourished during the first six months of life on a diet of highly centrifugated milk supplemented with cane sugar to give the proper caloric value. Although both of these children showed signs of interrupted growth during this period and suffered from the prevailing epidemic of grippe, the general condition and weight at the end of the period was such as to lead the author to the conclusion that the theoretical fat minimum of the human infant as shown by these two experiments is so small as to be practically negligible. He thus takes exception to the conclusions of Aron previously noted (E. S. R., 41, p. 264) that a minimum of fat is essential to proper nutrition. The question of vitamins is apparently neglected in this study, and the emphasis is laid solely on a minimum of protein supplemented by sufficient energy value to be obtained either from carbohydrate or fat, interchangeable according to their isodynamic value. It is, however, suggested that the isodynamic principle can be applied with greater safety if equicaloric amounts of actual foods are considered rather than equicaloric values of purified food constituents.

The nutritive value and significance of food fats, H. Aron (*Biochem. Ztschr., 103 (1920), No. 4–6, pp. 172–177*).—In this reply to the foregoing paper the author points out that the two cases mentioned by Von Gröer showed signs of lowered nutritive condition early in the experiment, and states that while infants can develop for a short time on a fat-free diet, failure to continue to grow and a lowered resistance to infectious diseases ultimately result. He further emphasizes that all fats are not interchangeable in their special or biological food value, citing in illustration that butter can not be replaced by vegetable fats or egg-yolk fat by lard and that liver oil is particularly good for children.

Grippe and whooping cough, Niemann (*Berlin. Klin. Wchnschr., 56 (1919), No. 33, pp. 777–779*).—In discussing an epidemic of grippe and whooping cough among about 50 children in Berlin, attention is called to the course of the disease among infants fed in different ways. Eleven of these infants were being fed on a fat-rich food including breast milk, protein milk, and a butter-flour preparation, while an equal number were fed on skim milk enriched by sugar. The fact that there were 9 fatalities in the second group and only 3 in the first is thought to indicate that children fed on a diet containing considerable fat have a higher resistance to infection than those on a carbohydrate-rich diet.

Growth on diets poor in true fats, T. B. Osborne and L. B. Mendel (*Jour. Biol. Chem., 45 (1920), No. 1, pp. 145–152, fig. 1*).—The authors point out that the controversy regarding the necessity for fats in the diet as noted in the above papers fails to emphasize adequately the distinction in the significance of fats as sources of energy and as carriers of vitamins and of lipoids whose real significance is still unknown. In regard to the report of Von Gröer in particular it is pointed out that centrifugated milk is not entirely free from either fat or fat-soluble vitamin; that it is not certain whether or not young animals have a store of this factor which only gradually becomes exhausted; and that the period of observation of the infants on the fat-free diet was too brief to be of real value.

To throw more light on the question of the dispensability of fat in the diet, new feeding experiments with rats have been conducted with diets consisting of meat residue 23 per cent (yielding 1.6 per cent ether extract), starch 72, and salt mixture 5 per cent. The necessary vitamins were given in tablets containing 0.4 gm. of brewery yeast, 0.2 gm. of dried alfalfa, and 0.2 gm. of cane sugar. These were fed apart from the rest of the food, which was given ad libitum. In two cases the amount of alfalfa was increased to 0.4 and 1 gm., respectively, after a short time. The three animals grew on this ration with vigor.

Another experiment was conducted on three more rats with a diet differing from the first only in that the meat residue was extracted five times with ether containing a little alcohol. On this diet, furnishing at the most a daily intake of 0.078 gm. of ether extract during a period when the weekly food intake was as high as 174 gm., the rats quadrupled their weight in usual time and appeared as well nourished as control rats on a diet containing liberal portions of fat. The authors conclude that "if true fats are essential for nutrition during growth, the minimum necessary must be exceedingly small."

Recent advances in science in their relation to practical medicine and the nutritional requirements of the body, F. G. Hopkins (*Lancet [London], 1921, I, No. 1, pp. 1–7*).—In this Huxley lecture before the Medical School of the University of London, the author discusses the standards of nutrition from the opposing viewpoints of the law of isodynamic equivalence and the law of the minimum.

The law of isodynamic equivalence, so named by Rubner, was treated on the theoretical side by a discussion of Rubner's teaching that any one foodstuff can replace any other so long as the replacement makes no change in the supply of energy, and on the practical side by a brief account of Von Pirquet's new system, which is also based primarily upon calorimetry. In contrast with these claims the newer conceptions of food requirements are briefly discussed, including the limits of interchangeability of fat and carbohydrate as recently discussed by Krogh and Lindhard (E. S. R., 44, p. 463), the differing nutritive values of various proteins, and finally the vitamin requirements. It is shown that the law of isodynamic equivalence fails in the light of these newer conceptions, and that a much more significant principle in nutritional phenomena is the law of the minimum, the working of which is outlined as follows:

"What we have actually to recognize is that each of several factors may become that which limits efficiency, and that no one of these is in any strict sense more important than any other. Normal nutrition calls for a certain minimum of each one and every one. If a diet is harmoniously balanced in a chemical sense, then indeed energy does become the sole limiting factor. Nutrition then fails, of course, only when too little of the diet is eaten to yield the essential minimum of energy. But the supply of fat may become the limiting factor, and no less that of carbohydrate. Or, again, when the supply of energy consumed is ample, with fat and carbohydrate duly adjusted, the circumstance that a single essential amino acid in one case, or a vitamin in another, is present in amount below the necessary minimum converts each of these in turn into the factor which limits utilization. Small as the necessary minimum in either case may be, unless it is reached the proper use of the rest of the diet is reduced to a degree which is proportional to the deficiency. If the deficiency be complete normal utilization is altogether impossible."

In discussing the relations of vitamin and protein deficiency to disease, brief reference is made to scurvy as illustrating the former and pellagra as in part due to the latter deficiency. The author emphasizes, however, that "if the application of all these considerations to practical medicine bore only upon the production of actual disease they would have far less importance than, in my belief, is actually attached to them. A deficiency which when extreme produces actual disease will, almost certainly, when less extreme involve some failure in health."

Vitamin studies.—VI, The influence of diet of the cow upon the nutritive and antiscorbutic properties of cow's milk, R. A. DUTCHER, C. H. ECKLES, C. D. DAHLE, S. W. MEAD, and O. G. SCHAEFER (*Jour. Biol. Chem., 45 (1920), No. 1, pp. 119–132, figs. 5*).—In continuation of the vitamin studies from the Minnesota Experiment Station (E. S. R., 43, p. 664), an extensive investigation is reported of the influence of fresh and dry feed or summer and winter feed on the antiscorbutic value of cow's milk. It is pointed out that the experiments conducted in this study differed from a similar study reported from the Wisconsin Station by Hart et al. (E. S. R., 43, p. 766) in that the milk was derived from the same cows throughout the experiment, while in the Wisconsin study the comparison was made on milk from two different herds.

In the present study two cows, a Jersey and a Holstein, were placed in the middle of January upon a vitamin-poor ration of equal parts of middlings, gluten feed, ground oats, and ground barley, adjusted to satisfy the requirements of the animals and supplemented by a roughage of equal parts of chopped timothy hay and oat straw. Mixed milk from the two cows was fed in varying quantities to several groups of guinea pigs, new groups being added from time to time. On June 1 the cows were put to pasture, the winter ration being continued, but in much smaller amounts, and the feeding experiment with the guinea pigs continued during the summer.

The data obtained showed conclusively that the antiscorbutic value of cow's milk is dependent upon the antiscorbutic value of the ration ingested by the cow. Greater protection against scurvy was obtained with 20 cc. of summer milk than with 60 cc. of winter milk. Milk obtained two weeks after the cows had been placed upon the vitamin-poor ration was much richer in antiscorbutic vitamin than that obtained a month later, indicating a slight storage of vitamin in the cow. Response to the vitamin-rich ration was very rapid, being noticeable within two weeks after the cows were put to pasture.

It is stated that similar studies are in progress with regard to vitamin A and vitamin B.

Relation of fodder to the antiscorbutic potency and salt content of milk, A. F. HESS, L. J. UNGER, and G. C. SUPPLEE (*Jour. Biol. Chem., 45 (1920), No. 1, pp. 229–235, figs. 2*).—The authors have studied the relation of feed to the antiscorbutic value of milk by a method differing from that of Hart et al. (E.

S. R., 43, p. 766) mainly in a delimitation of the duration of the feeding periods and in the inclusion of a chemical examination of the milk.

Five grade Holstein cows which had been freshened about 2 months previously were stall-fed through the winter on a normal winter ration of silage, hay, and concentrates. On April 30, 1920, they were put on a daily ration of 25 lbs. of a concentrate mixture consisting of 1 part of bean meal, 2 parts of oil meal, 2 parts of hominy, 2 parts of gluten meal, and 2 parts of bran, and also received 8 lbs. of kiln-dried beet pulp, 4 qts. of molasses, and 12 lbs. of straw. After 3 weeks on this ration, during which time there was a considerable decrease in milk flow, a mixed sample of milk from the 5 cows was obtained and evaporated by means of the Just roller process at a temperature of 230° F. for a few seconds. The cows were then placed on pasture for 3 weeks, during which time, except for the first 2 or 3 days, in which some concentrates were given, they received only fresh grass. At the end of 3 weeks another mixed sample of the milk was taken and dried as before. This procedure made it possible to test both varieties of milk at the same time and to use identical products for as long a period as necessary.

Guinea pigs were fed oats and bran ad libitum plus 80 cc. of the dried milk diluted with water to its original content. All of the 5 guinea pigs fed with dry-fodder milk developed scurvy within 21 days and died within 56 days, while the 3 animals fed on the pasture milk were all alive after 120 days, 2 showing mild signs of scurvy.

These experiments are thought to show not only the marked difference in antiscorbutic values of the two kinds of milk but also that the antiscorbutic vitamin is rapidly secreted into the milk by the lacteal glands and not stored in the body.

Chemical analysis of the milk, using the liquid milk in every determination except that of lecithin in which the dried milk was used, showed similarity in results except in the percentages of calcium, phosphorus, and citric acid, which were all higher in the pasture milk, and of sulphur, which was somewhat lower in the pasture milk, although the protein was a trifle higher.

"The percentages of calcium and of phosphorus in the antiscorbutic-free milk are below the normal; those of the pasture milk are within normal limits. The question of a casual relationship naturally suggested itself between the lack of antiscorbutic vitamin and the decreased excretion of these salts into the milk. A conclusive answer to this question must be postponed, however, until further data are available. The increase in citric acid may be explained in part by the greater amount of citrates contained in the green fodder, but gains added interest in view of the close association between citric acid and many of the most potent antiscorbutic foodstuffs. In view of the marked variation of this constituent in the two varieties of milk, normal figures which have been established without regard to the fodder of the cows must be regarded as incomplete. In fact, a lesson to be derived from this chemical examination of antiscorbutic-free and of pasture milk is the danger of setting up rigid standards for milk constituents and the necessity of prefacing such results with full data as to the diet of the lactating animal."

Production of polyneuritis in pigeons by the use of a synthetic ration, H. SIMONNET (*Compt. Rend. Soc. Biol. [Paris], 83 (1920), No. 35, pp. 1508–1510*).—Attention is called to the deficiency in one or more factors of the basal diets commonly used in the study of avian polyneuritis. The ration used by the author has the following composition: Meat residue prepared by double extraction with boiling alcohol and ether 11 gm., Osborne and Mendel's salt mixture 4, pulverized agar 5, peanut oil heated for 3 hours at 130° C. 5, cellulose 5, butter melted, decanted, and filtered at a temperature below 40° 10, and potato starch 60 gm. These ingredients are intimately mixed with 80 per cent of their weight of water and made into pellets, which are introduced into the crops of the experimental pigeons in two daily doses in amounts equal to one-fifth the weight of the bird. The pigeons are kept in very large cages to allow considerable freedom.

On the above diet the pigeons are said to maintain their weight but to develop a spasmodic form of avian polyneuritis unaccompanied by paralytic and atrophic symptoms, in the development of which inanition and multiple deficiencies are considered to play the important rôle. The disease appears generally in about 30 days, and is usually fatal in about 4 days if no treatment is given. The administration of dry or autolyzed yeast brings about prompt recovery. By supplementing the deficient ration by the administration of 0.5 gm. of dried yeast daily, the pigeons can be maintained in excellent health for more than 7 months.

Further experiments for preservation of lemon juice, P. W. Bassett-Smith (*Lancet [London], 1920, II, No. 20, pp. 997, 998, fig. 1*).—Lemon juice concentrated as previously described (E. S. R., 44, p. 361) has been shown to keep indefinitely without molding or fermenting. Boiling the lemon juice for 5 minutes before concentrating was found not to diminish appreciably its antiscorbutic content, but heating it at 58° C. for 45 minutes diminished it to a marked degree as shown by feeding experiments with guinea pigs. In connection with these experiments the author notes that the addition of 1 cc. of fresh blood to a basal scorbutic diet did not prevent the onset of scurvy.

Botulism, E. C. Dickson (*Amer. Jour. Pub. Health, 10 (1920), No. 11, pp. 865–871*).—This is a general discussion of the subject, with particular reference to the relationship of *Bacillus botulinus* to the preservation of foods whether at home or commercially. It is emphasized that boiling canned foods will always render them safe with respect to botulinus toxin, but that canned foods that show any signs of spoilage should be destroyed.

Botulism (*Med. Sci., Abs. and Rev., 3 (1921), No. 5, pp. 411–414*).—A review of recent literature, most of which has been noted from the original sources.

Absorption and elimination of manganese ingested as oxids and silicates, C. K. Reiman and A. S. Minot (*Jour. Biol. Chem., 45 (1920), No. 1, pp. 133–143*).—To determine the possibility of manganese poisoning among workers with manganese ores, a study in vitro was made of the solubility of manganese compounds in gastric juice and in vivo of the effect of ingested manganese ores on the manganese content of the blood and the manner of its elimination. The effect on the blood and tissues of dogs of prolonged feeding of large amounts of manganese ores was also determined.

Although ores containing manganese as oxids and silicates were soluble in gastric juice and the manganese was absorbed in the blood stream, a rapid return to normal manganese content was almost universally the case. Prolonged feeding of large amounts of manganese to dogs failed to cause any pathological symptoms. "Manganese ores are thus very nontoxic and in order to produce symptoms of poisoning must be ingested by individuals who are peculiarly susceptible. Clinical experience has demonstrated that such persons are extremely rare."

ANIMAL PRODUCTION.

Report of the committee on genetic form and nomenclature, C. C. Little et al. (*Amer. Nat., 55 (1921), No. 637, pp. 175–178*).—This report to the American Society of Naturalists deals mostly with the method of designating genes. It is suggested that subscripts be used to distinguish between different series of allelomorphs where the literal symbols are the same, and that superscripts designate allelomorphs when there are more than two in a series.

Genetics of the "chinchilla" rabbit, W. E. Castle (*Science, n. ser., 53 (1921), No. 1373, pp. 387, 388*).—The author reports breeding experiments with rabbits having the so-called chinchilla coat, that is a pearl-gray color similar to the color of the wild rabbit but with the yellow ticking replaced by white and the black portions toned down to a slaty blue. Chinchilla is the fourth member of the albino series of allelomorphs and is recessive to normal pigmentation and dominant to Himalayan and ordinary albinism. It is suggested that large chinchilla pelts, for which there is a demand in the fur trade, could be secured by mating pure chinchillas to white Flemish. The meat characters and the quality of the pelt could be further improved without loss of the chinchilla color by continued crossing back to the white Flemish.

The formation of the secondary sexual characters by the gonads, A. Lipschutz (*Arch. Entwickl. Mech. Organ., 44 (1918), No. 2, pp. 396–410*).—This is a review of a large number of published castration and gonad-transplantation experiments. A sharp distinction is made between characters influenced by the gonads and those due to the "asexual embryonic form." The latter group includes the feathering and spurs of cocks and perhaps the combs and wattels of hens, but no clear cases among mammals are cited.

The influence of ovarian hormones on the growth of the pelvis, I. R. Plaut (*Hoppe-Seyler's Ztschr. Physiol. Chem., 111 (1920), No. 1, pp. 36–42*).—Five young rabbits, 2 young cats, and 1 young guinea pig received subcutaneous injections of the ether extract of the ovary of the cow for 2 or 3 weeks and then after a period of observation were killed. Litter mates furnished the controls.

It was found that the pelves of the injected animals tended to approach the adult form, particularly when the ovary furnishing the extract contained a corpus luteum. The change was shown by a widening of the angle of the pubes and variations in the mutual ratios of the three diameters measured.

On the composition and digestibility of a reed (Arundo phragmites) and a bullrush (Scirpus maritimus), F. Honcamp and E. Blanck (*Landw. Vers. Sta., 90 (1917), No. 1–2, pp. 113–122*).—Digestion experiments with sheep are reported.

The percentage composition (dry basis) of the reed was as follows: Crude protein 7.59, ether extract 1.28, crude fiber 37.48, and nitrogen-free extract 44.47. On an average the two sheep digested 33.3 per cent of the organic matter, 36.5 of the crude protein, 40.6 of the crude fiber, and 26.6 per cent of the nitrogen-free extract. The bullrush on a water-free basis contained 10.29 per cent of crude protein, 2.2 per cent ether extract, 30.98 per cent crude fiber, and 46.02 per cent nitrogen-free extract. The average digestion coefficients of the two animals were as follows: Organic matter 43.3, crude protein 42.6, crude fiber 51.7, and nitrogen-free extract 37.6.

Molinia hay: Its composition and feeding value, F. Honcamp and O. Nolte (*Landw. Vers. Sta., 93 (1919), No. 1–2, pp. 91–95*).—Hay made from *Molinia coerulea* cut in an early stage was used in digestion trials with two sheep. On a water-free basis the hay had the following percentage compositions: Crude protein 15.34, crude fat 2.33, crude fiber 26.24, and nitrogen-free extract 50.67. The mean digestion coefficients were: Organic matter 65.5, crude protein 71.8, crude fat 27.9, crude fiber 66.3, and nitrogen-free extract 64.9.

A comparative study of the composition of the sunflower and corn plants at different stages of growth, R. H. Shaw and P. A. Wright (*Jour. Agr. Research [U. S.], 20 (1921), No. 10, pp. 787–793*).—In this study from the Dairy

Division of the U. S. Department of Agriculture chemical analyses were made of the sunflower plant and the corn plant at different stages of growth.

It was found for both species that the percentage of dry matter increased gradually and consistently throughout the growth period, and that the percentage of crude protein in the dry matter decreased. The two species differed chiefly in the carbohydrates. The starch content of the corn increased rapidly after the milk stage, reaching a maximum (nearly 25 per cent of the dry matter) at the stage when all the kernels were glazed. In the sunflower the maximum starch content (4.6 per cent of the dry matter) occurred before the formation of the first flowers and thereafter declined irregularly. In the corn plant the reducing sugars were greatly in excess of the nonreducing sugars throughout and the sugar content was at a maximum at the time the kernels were forming. In the sunflower the difference in the amounts of the two classes of sugar were less marked, and in the first stage when the plants were 3 ft. high the nonreducing sugars were in excess. The sugar content was highest in the early stages and declined steadily as maturity was reached.

From a study of the composition it is concluded that the stage in which the ray flowers have become dry and are beginning to fall is the best for harvesting sunflowers destined for silage.

Sunflower silage digestion experiment with cattle and sheep, R. E. Neidig, R. S. Snyder, and C. W. Hickman (*Jour. Agr. Research [U. S.], 20 (1921), No. 11, pp. 881–888*).—At the Idaho Experiment Station 7-day digestion trials were made with three Shorthorn cows and three Shropshire wethers fed sunflower silage that had been cut when about 50 per cent of the flowers were still in bloom and only a few of the seeds had reached the dough stage. The moisture content of the silage was 78.79 per cent, and on the dry basis it contained 9.59 per cent crude protein, 5.82 per cent ether extract, 29.72 per cent crude fiber, and 45.03 per cent nitrogen-free extract. The average digestion coefficients for the cows were as follows: Dry matter, 51.7; crude protein, 47.8; ether extract, 73.7; crude fiber, 37.4; and nitrogen-free extract, 56.3. The averages for sheep were: Dry matter, 58.8; crude protein, 54.4; ether extract, 77.4; crude fiber, 46.7; and nitrogen-free extract, 69.8. The apparent digestibility of the ash was 26.6 per cent with the cows and 38.5 with the sheep.

Attention is called to differences between the experimental animals of the same species in ability to digest the silage, but it is thought that the averages are representative, since the percentages of digestible nutrients resemble those in the sunflower silage used in digestion trials at the Montana Station. (E. S. R., 43, pp. 68, 770.)

Bacteria concerned in the ripening of corn silage, P. G. Heineman and C. R. Hixson (*Jour. Bact., 6 (1921), No. 1, pp. 45–51*).—Silage from three silos was sampled periodically from November to June for chemical and bacteriological study.

The fermentation was found to consist of three phases, each brought about by a characteristic group of bacteria. The initial phase, of short duration, is caused by members of the colon aerogenes group, and is accompanied by the formation of acid and gas. The second phase is characterized by the presence of streptococci and the moderate formation of acid In the early and more active stage the streptococci appear chiefly in the diplococcus form, but later chain formation is more common. The third phase is the result of the activity of lactobacilli, of which a slow-growing and a rapid-growing type were recognized. Evidence of butyric acid bacilli could not be found, and there was no significant growth of yeast, although yeast cells were invariably present.

Cellulose as a feeding stuff, H. Edin (*Meddel. Centralanst. Försöksv. Jordbruksområdet, No. 168 (1918), pp. 15, fig. 1; also in K. Landtbr. Akad. Handl. och Tidskr., 57 (1918), No. 4, pp. 278–290, fig. 1*).—Digestion trials are reported with goats fed various kinds of paper pulp in conjunction with "cake" and sliced sugar beets. Using digestion coefficients for the concentrates and beets determined in other experiments, the following results were secured:

Composition and digestibility of paper-pulp feeds.

Paper pulp feeds.	Composition.[1]				Digestibility (goats).		
	Crude protein.	Ether extract.	Crude fiber.	N-free extract.	Organic matter.	Crude fiber.	N-free extract.
	Per ct.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
Straw pulp-wet mass	1.07	0.79	64.39	19.15	76.6	84.8	57.3
Straw pulp and molasses—air dry	1.99	.59	55.88	25.97	88.0	92.5	86.3
Fir wood sulphite pulp—dried and ground	.12	.81	69.12	18.61	86.6	93.4	70.5
Fir wood sulphate pulp—dried and ground	.15	.24	72.82	15.45	88.4	95.8	63.3
Fir wood sulphate pulp—in pulp form	....	....	....	....	91.3	98.6	57.0

[1] Reduced to a uniform moisture content of 10 per cent.

Feeding experiments are also reported in which paper pulp formed a satisfactory partial substitute for oats in the ration of horses.

On the inheritance of ear length in sheep, C. Wriedt (*Ztschr. Induktive Abstam. u. Vererbungslehre, 20 (1919), No. 3, pp. 262, 263*).—The author reports a limited amount of data on the inheritance of ear length in Norwegian sheep. In one flock where short-eared sheep occurred matings of long-eared sheep alone never produced short-eared lambs, while short-eared×long-eared matings did give rise to short-eared lambs. These data confirm the conclusions of Ritzman (E. S. R., 35, p. 772) that the short-ear character is dominant to the long ear. However, in another part of the country there was a farm where earless sheep occurred, and in a short-eared×short-eared mating in this flock there were produced 2 short-eared and 2 earless lambs. The author is inclined to lump these 4 lambs with the 1 long-eared and 3 short-eared lambs secured by Ritzman from a short-eared×short-eared mating, and to conclude that the short-ear condition is the heterozygote intermediate between long ears and earless.

The short ears observed in these flocks were about 4 cm. long and were in all cases sharply marked from the long-ear type.

Breeding earless sheep, E. G. Ritzman (*Jour. Heredity, 11 (1920), No. 5, pp. 238–240, figs. 4*).—In breeding experiments at the New Hampshire Experiment Station in which short-eared rams known to have a long-eared parent were mated to long-eared ewes there have been produced 16 short-eared and 16 long-eared lambs. Matings between a short-eared ram and short-eared ewes have produced 1 earless, 3 short-eared, and 1 long-eared lamb. The author therefore modifies his previous conclusion (E. S. R., 35, p. 772) that short ear is dominant to long ear, and concludes that the short-eared condition is the heterozygote intermediate between earless and long ears.

[**Costs and profits in sheep farming**], S. C. Hartman (*Ohio Sta. Bul. 344 (1920), pp. 357–360, fig. 1*).—Records of costs, feeding consumption, and labor in connection with a flock of sheep at the Washington County Experiment Farm (Southeastern Ohio) in 1918 and 1919 are presented, together with a brief analysis of the factors affecting profits in sheep and wool production. The importance of the lamb crop is emphasized.

Summer hog feeding, H. J. Gramlich (*Nebraska Sta. Bul. 176 (1920), pp. 20, figs. 5*).—Two hog feeding experiments are reported, of which the second has already been noted from Bulletin 245 of the Nebraska Board of Agriculture (E. S. R., 41, p. 675).

The first experiment began May 26, 1917, lasted 45 days, and involved four lots of 10 hogs each. The methods of feeding and the results obtained are summarized in the following table:

A 45-day comparison of tankage and semisolid buttermilk for hogs on pasture and in the dry lot.

Lot.	Pasture.	Initial weight per head.	Ration (free choice).			Daily gain per head.	Consumed per pound of gain.		
			Corn.	Tankage.	Buttermilk.		Corn.	Tankage.	Buttermilk.
		Lbs.	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*
1	None	143.3	6.4	0.36	....	1.76	3.63	0.20	....
2	Rape	142.3	7.5	.25	....	2.06	3.65	.12	....
3	None	144.3	8.5	....	1.24	1.93	4.41	....	0.64
4	Rape	144.0	8.7	....	1.24	2.26	3.85	....	.55

Heredity in horses, H. K. Bush-Brown (*Jour. Heredity, 11 (1920), No. 5, pp. 215–227, figs. 12*).—The author has examined the skeletons of Arab horses in museums and elsewhere and finds that they uniformly have only five lumbar vertebrae. The Thoroughbred, however, usually has six. The reduction in number is due to the loss of the sixth vertebra and not to the development of ribs on the first. The great endurance of the Arab in long-distance tests is attributed to the mechanical advantages of the shortened back. It is also stated that the ass has only five lumbar vertebrae.

Use of synthetic diets in the growth of baby chicks.—A study of leg weakness in chickens, E. B. Hart, J. G. Halpin, and H. Steenbock (*Jour. Biol. Chem., 43 (1920), No. 2, pp. 421–442, pls. 2, figs. 23*).—The authors, working at the Wisconsin Experiment Station, used a synthetic ration for baby chicks composed of purified casein, dextrin, butter fat, brewers' dried yeast, and a complex salt mixture. This ration given alone or mixed with agar, phenolphthalein, lactose (10 per cent of the ration), sand, or fuller's earth produced leg weakness and early death. Since leg weakness was not prevented by feeding green cabbage, green clover, or orange juice, it is concluded that the condition is not a chicken scurvy. The use of filter paper, as suggested by Osborne, Mendel et al. (E. S. R., 40, p. 876), resulted in normal growth without leg weakness provided the paper was intimately incorporated with the feed. Filter paper to the extent of 10 per cent of the ration gave the best results. The inclusion of dirt or charcoal in the feed prevented leg weakness to some extent.

It was thought that the roughages might function in preventing leg weaknesses by absorbing the toxic material generated in the intestinal tract, but no evidence could be found by means of the precipitin reaction that food proteins as such were traversing the intestinal wall in cases of leg weakness. Although fowls suffering from leg weakness appear anemic, the hemoglobin content of the blood was found not to be subnormal.

Green feed v. antiseptics as a preventive of intestinal disorders of growing chicks, A. G. PHILIPS, R. H. CARR, and D. C. KENNARD (*Jour. Agr. Research [U. S.], 20 (1921), No. 11, pp. 869–873; abs. in Indiana Sta. Rpt. 1920, pp. 31, 32*).—As a contribution to the technique of raising chicks in confinement, the authors report a 14-week experiment at the Indiana Experiment Station with 10 lots of 16 newly hatched White Leghorn chicks in which an attempt was made to discover what additions to a basal ration of cracked corn, corn meal, corn bran, meat scrap, soy bean meal, and a mineral mixture would reduce the mortality due to intestinal disturbances.

The check lot which received the basal ration without additions showed the lowest mortality (no deaths) during the first 8 weeks and the highest mortality (6 deaths) during the critical period following the eighth week. In the 2 lots fed pulped strawboard there were 3 deaths during the last 6 weeks and 11 during the first 8. The addition of straw to the ration of 1 lot and straw and sprouted oats to that of another was accompanied in each case by 3 deaths in the first period and 5 in the second, and the average weights of the surviving chicks at 14 weeks were lower than in any of the other lots. Data from 4 lots used in other experiments are cited in confirmation of the conclusion that sprouted oats do not reduce mortality.

The feeding of lactose seemed to be without value in reducing mortality or promoting growth, due, it is thought, to the absence of sugar-splitting enzyms in the bird's intestine as suggested by Mendel and Mitchell (E. S. R., 20, p. 265). The addition of tobacco dust retarded growth in the early stages and made the birds nervous. Sulphur in the feed reduced mortality somewhat in the second period and acted as a laxative. In the pen where hydrochloric acid was added to the drinking water there were 4 deaths in the first period and only 1 in the second, and growth approximated that of the check lot. The addition of 1 part of copper sulphate to 100 parts of drinking water was tried with one lot; there were only 2 deaths—both in the first 8 weeks—and the growth was greater than in any other lot.

Data on the nitrogen excretion are included. The excreta of the chicks receiving hydrochloric acid or tobacco dust showed a low nitrogen content, which is attributed to a lowered elimination of uric acid since the decrease was most marked in the fraction of the excreta not soluble in N/10 HCl.

[Poultry feeding experiments at Purdue University] (*Indiana Sta. Rpt. 1920, pp. 30, 31*).—A pen of 30 White Plymouth Rock pullets fed wheat, oats, bran, and shorts (2:1:1:1) without supplement laid 50.7 eggs per bird. A similar pen given 1.6 lbs. of meat scrap with 25 lbs. of the basal ration laid 106.2 eggs, and other pens fed 2, 3, and 4 times this amount of meat scrap produced 106.9, 109, and 110.9 eggs, respectively.

White Leghorn pullets fed corn, wheat, oats, bran, and shorts (3:1:1:1:1) without supplement laid 65.4 eggs per bird. The addition of dried buttermilk increased the production to 193.4 eggs, but the use of liquid buttermilk in place of the dried buttermilk reduced the yield to 158.5 eggs.

Feeding laying hens, A. G. PHILIPS (*Indiana Sta. Circ. 101 (1921), pp. 16, figs. 5*).—This consists of directions for feeding hens, based mainly on results secured at the station.

British egg-laying tests or trials, E. BROWN (*Rel. Poultry Jour., 28 (1921), No. 1, pp. 65, 66, 104–106, figs. 4*).—This is a survey of the development of the egg-laying tests in the British Isles. The author deplores the tendency for these trials to degenerate into mere competitions and urges that they be organized to increase knowledge of poultry breeding.

Size of egg in relation to average production, E. BROWN (*Jour. Min. Agr. [London], 28 (1921), No. 1, pp. 63–70, figs. 4*).—This is a study of the weights of eggs laid during the 1918–19 small flocks laying trials at the Harper Adams College. It was found that the increase in the size of the eggs during the first two or three months of the laying year parallels the increase in percentage production, but that size is maintained later in the season when production declines. It is thought that heavy annual production rather than heavy winter production as such tends to increase the proportion of underweight eggs.

[Reports of the 1918–19 and 1919–20 egg-laying trials at the Harper Adams College] (*Utility Poultry Jour., 4 (1919), No. 11, pp. 13, 15, 17, 19, 21, 23, 25, 27, 43–45, 47, 49, 51, 53–55, 57–74, figs. 5; Sup., pp. 3–15, 17–24; 5 (1920), No. 12, pp. 588–599, 617–632*).—These are the reports of the seventh and eighth annual egg-laying trials held at Newport, Shropshire, and continue those previously noted (E. S. R., 41, p. 370).

A progeny test of a limited number of male birds is announced to begin in the spring of 1921. Each cock will be mated to 5 hens whose pullet egg records ranged from high to low in a previous trial. Six daughters from each of these hens will be tested for a year under laying trial conditions.

Final results of live stock for the year 1919–20, and report thereon, W. L. JOHNSTON (*So. Aust. Statis. Dept. Bul. 2 (1920), pp. 6*).—Statistics are given for the year ended June 30, 1920, as to the numbers of cattle, horses, sheep, pigs, goats, and other stock in the several political divisions of South Australia, together with information on the market prices of stock, the wool clip, and dairy production.

DAIRY FARMING—DAIRYING.

Observations on the body temperature of dry cows, M. KRISS (*Jour. Agr. Research [U. S.], 21 (1921), No. 1, pp. 1–28, figs. 46*).—Observations of the body temperature of two dry cows (Jerseys) were made at the Pennsylvania Institute of Animal Nutrition during 16 weeks in the winter of 1919–20. Except when changed for experimental purposes, the cows were kept on a maintenance ration, were fed twice a day (6 a. m. and 5 p. m.) and were watered once a day (8 a. m.).

It was found that the rectal temperatures were usually higher than the vaginal temperatures, the average difference at a depth of 7 in. being about 0.3° F. Since the vagina is more exposed to the atmosphere, the rectum is considered the most suitable place for making temperature determinations. Insertion of the thermometer at different depths showed distinctly lower temperatures toward the exterior and the readings did not approach a constant figure until a depth of 6 or 7 in. was reached.

A falling temperature invariably followed the drinking of water, while feeding raised the temperature slightly during the following half hour. Neither defecation nor the position of the animal (whether lying or standing) seemed to influence the temperature to any important extent, but there was some indication of a slight fluctuation in temperature immediately after a change in position. Aside from the influence of water drinking the temperature remained practically constant until about 2.30 p. m., when a gradual rise began.

A difference of 0.8° in the rectal temperature of the same animal at 5 p. m. on two successive days was observed. Readings made on successive days at 9 a. m. varied as much as 1.3°, due to the influence of drinking. Apparently the daily fluctuations at 5 p. m. are not considered large enough to interfere with the accurate determination of heat production in 24 or 48 hour respiration calorimeter experiments.

Environment and breeding as factors influencing milk production, A. C. MCCANDLISH (*Jour. Heredity, 11 (1920), No. 5, pp. 204–214, figs. 11*).—This is a summary of an experiment in grading up dairy cattle previously noted from Iowa Station Bulletin 188 (E. S. R., 41, p. 182), with some additional data and new photographs of the cows. Twelve second generation cows have completed 19 lactations, and their average milk record corrected to maturity averaged 116 per cent higher than the similarly corrected lactation records of their scrub granddams. The fat production averaged 106 per cent higher. The Holstein grades showed greater relative increases than the Guernsey and Jersey grades. Eight first generation cows that were mothers of second generation heifers with lactation records gave 55 per cent more milk and 44 per cent more fat than their scrub dams.

The value of the purebred sire in increasing the production of a scrub herd, A. C. McCandlish (*Jour. Dairy Sci., 4 (1921), No. 1, pp. 12–23, pls. 5*).—This contains essentially the same material as in the paper noted above, but the data are given in greater detail.

Corn stover silage v. corn silage for milk production, F. B. Morrison, G. C. Humphrey, and R. S. Hulce (*Jour. Dairy Sci., 4 (1921), No. 1, pp. 29–31*).—At the Wisconsin Experiment Station 8 cows were divided into two groups and fed corn silage or corn stover silage by the reversal method during two 4-week periods. The grain and hay rations were not varied with the kind of silage. The cows consumed 33.25 lbs. of corn silage per head per day and produced 27.4 lbs. of milk and 1.05 lbs. of butter fat per cow. The average consumption of the stover silage was only 28.31 lbs. per day, while the milk yield averaged 24.5 lbs. and the fat yield 0.98 lb. The cows lost somewhat in weight on both rations, the decrease being greater during corn silage feeding.

The dairy industry in the United States (*La Industria Lechera en los Estados Unidos. Washington: Argentine Embassy, 1921, pp. 216, pls. 16, figs. 6*).—This treatise was prepared for the Sociedad Rural Argentina in connection with an international dairy exposition to be held in May, 1921. Manufacturing processes, the management of milk plants, and the commercial organization of the dairy industry are emphasized. A large number of the publications on dairying issued by the U. S. Department of Agriculture, the standard American treatises on dairying, and the principal dairy magazines published in the United States are listed.

Whole-milk consumption, T. R. Pirtle (*Milk Mag., 8 (1920), No. 3, pp. 5–7, 25, 26, fig. 1*).—This is a summary of available data as to the consumption of milk in various countries of the world.

California dairy products (1919–20), C. F. Hoyt and H. G. Asselstine (*Calif. Dept. Agr., Div. Anim. Indus. Circ. 3 (1921), pp. 54, figs. 11*).—Statistics of the production and manufacture of dairy products in California are presented, with maps showing the distribution of the various dairy industries throughout the State.

Some provisions of California laws on dairying, C. F. Hoyt (*Calif. Dept. Agr., Div. Anim. Indus. Circ. 1 (1920), pp. 10*).—This is a digest of the more important California laws on dairying, and supplements a pamphlet giving the text of the laws, previously noted (E. S. R., 44, p. 75).

Labor used in bottling milk with machines operated by hand levers (*U. S. Dept. Agr., Bur. Anim. Indus., Milk-Plant Letter 86 (1921), pp. 2; also in Milk Dealer, 10 (1921), No. 8, p. 78; Creamery and Milk Plant Mo., 10 (1921), No. 6, p. 53*).—Continuing a previous study of the labor used in bottling milk (E. S. R., 44, p. 574), there are here presented data from 21 milk plants in which the bottles were filled and capped by machines operated with hand lever. An average of 768 bottles were filled and capped per man-hour.

Some important factors in the production of good milk and cream, C. F. Hoyt (*Calif. Dept. Agr., Div. Anim. Indus. Circ. 2 (1920), pp. 15, figs. 2*).—A survey of the problem of the bacterial contamination of milk with a number of bibliographical references.

Improved technique for the micro or little plate method of counting bacteria in milk, W. D. Frost (*Jour. Infect. Diseases, 28 (1921), No. 2, pp. 176–184, figs. 8*).—For use in the field in making bacterial counts of milk by his little plate method (E. S. R., 36, p. 574), the author describes a portable combination incubator and carrying case for apparatus. The standardized procedure for making the test is given in detail, including some minor modifications which are suggested. It is stated that prolonged incubation (16 to 24 hours) does not affect the count, although a period of only 4 hours is necessary.

Grading milk by the acid test: Influence of acids in the ration on the acidity of milk, H. H. Sommer and E. B. Hart (*Jour. Dairy Sci., 4 (1921), No. 1, pp. 7–11*).—A cow at the Wisconsin Experiment Station was given concentrated sulphuric acid in water mixed with silage and stover for 23 days, the daily dose increasing from 30 to 120 cc. This treatment did not change the titratable acidity, the coagulability by heat, nor the H-ion concentration of the milk, but the urine, which was alkaline (pH=8.21) before acid feeding, became markedly acid (pH as low as 5.83), and the percentage of urinary nitrogen in the form of ammonium salts increased from 0.27 to 6.35. In view of these results with an inorganic acid and those by Turner and Beach (E. S. R., 16, p. 1010) with the organic acids of silage, it is considered improbable that the apparent acidity of milk can be altered by changes in the feed.

Previous work of the authors (E. S. R., 42, p. 208) has shown that milk of high apparent acidity is not necessarily undesirable for condensing purposes. A modification of factory practice in using the acid test is proposed so that normal fresh milk will not be rejected on account of acidity not due to bacterial fermentation.

The relationship between the H-ion concentration and the bacterial content of commercial milk, E. W. Schultz, A. Marx, and H. J. Beaver (*Jour. Dairy Sci., 4 (1921), No. 1, pp. 1–6, fig. 1*).—The authors have estimated the H-ion concentration of a large number of samples of market milk by colorimetric methods. The counts increased rapidly from about 3,000 per cubic centimeter at pH=6.8 to about 100,000 at pH=6.5, but did not increase much with further increases in acidity. The acidity was not detectable by taste until pH=6. Although definite conclusions are not drawn from this work, it is suggested that further study may make it possible to use the pH values, which can be determined in a few minutes, for estimating the bacterial content of milk.

The acidity of goat's milk in terms of H-ion concentration, with comparisons to that of cow's and human milk, E. W. Schultz and L. R. Chandler (*Jour. Biol. Chem., 46 (1921), No. 1, pp. 129–131*).—In 160 determinations of the H-ion concentration in fresh goat's milk, pH varied from 6.7 to 6.4, the average being 6.53. In completely soured milk, pH varied from 4.4 to 3.7 and averaged 3.92. Examination of the literature showed that fresh goat's milk is slightly more acid than fresh cow's milk and appreciably more acid than human breast milk.

The size of fat globules in goat's milk, E. W. Schultz and L. R. Chandler (*Jour. Biol. Chem., 46 (1921), No. 1, pp. 133, 134*).—The diameters of the fat globules in 45 samples of goat's milk were measured. The diameter was less than 4 μ in 91 per cent of the fat globules and less than 2 μ in 57 per cent. The measurements tabulated by Bitting (E. S. R., 13, p. 884) showed that over 90 per cent of the fat globules in cow's milk exceeded 4 μ in diameter. "With the quantity of fat practically the same, it becomes obvious that the fat in goat's milk, being more highly dispersed, possesses an enormously greater surface area than does that of either cow's or human milk. It should, therefore, be considerably more accessible to the lipase of the digestive juices, and consequently more rapidly and completely digested."

A study of lactose-fermenting yeasts present in "yeasty" cream, B. W. HAMMER and W. A. CORDES (*Iowa Sta. Research Bul. 61 (1920), pp. 3–24*).—This is a study of the morphological, cultural, and biochemical characters of two lactose-fermenting yeasts, *Torula cremeris* n. sp. and *T. sphaerica* n. sp. The former was isolated from 20 of 21 samples of "yeasty" cream, 7 of 9 samples of No. 2 cream, 11 of 71 samples of clean-flavored sour cream, 2 samples of Iowa milk, a sample of milk from Denmark, and a sample of matzoon originally from Armenia but possibly exposed to infection in the United States. *T. sphaerica* was found in the remaining sample of "yeasty" cream, in 1 sample of No. 2 cream, and in 1 sample of clean-flavored cream. In no case were the two species found together. *T. cremoris* is the larger and was usually oval in form.

These yeasts were found to grow readily in milk and in sweet cream, but produced the characteristic foaming only in cream that was more or less coagulated.

Sandiness in ice cream (*Indiana Sta. Rpt. 1920, p. 18*).—It is stated that experiments at the station warrant the conclusion that sandiness in ice cream is due to the precipitation of milk sugar after the freezing process is completed. The defect can be controlled to some extent by keeping the proportion of milk solids in the mix below 10 or 12 per cent, and also by using particular combinations (not specified) of gums, gelatin, and coagulants.

VETERINARY MEDICINE.

Textbook of special pathology and therapy of domestic animals, E. FRÖHNER and W. ZWICK (*Lehrbuch der Speziellen Pathologie und Therapie der Haustiere. Stuttgart: Ferdinand Enke, 8. rev. ed., vol. 2, 1919, pt. 1, pp. XVI+655, figs. 180; 1920, pt. 2, pp. XI+623, pls. 3, figs. 182*).—This volume of the new edition, volume 1 of which has been previously noted (E. S. R., 36, p. 478), is a continuation of the account on infectious diseases. Included at the end is a classified bibliography of 133 pages, relating to the infectious diseases dealt with in the two parts of volume 2. The plates and many of the figures are in colors.

Outlines of clinical diagnosis of internal diseases of domestic animals, B. MALKMUS (*Grundriss der Klinischen Diagnostik der Inneren Krankheiten der Haustiere. Leipzig: Max Jänecke, 1920, 8 and 9. ed., pp. VII+232, figs. 67*).—A new edition of this work, of which the English translation of the fourth edition has been previously noted (E. S. R., 27, p. 77).

Haubner's veterinary medicine for the agriculturist, edited by O. RÖDER (*Haubner's Landwirtschaftliche Tierheilkunde. Berlin: P. Parey, 1920, 18. rev. ed., pp. XII+783, figs. 165*).—This is the eighteenth revised edition of the work previously noted (E. S. R., 26, p. 578).

[Report of the department of] veterinary science (*Indiana Sta. Rpt. 1920, pp. 43–47*).—Hog cholera feeding experiments failed to demonstrate the presence of the virus in the urine and feces of hogs having acute cholera. In infection experiments, healthy controls, separated from pigs inoculated with cholera blood by wire partitions placed 3 ft. apart, contracted the disease in from 17 to 23 days. Numerous attempts made to isolate *Bacillus suipestifer* from the feces of hogs affected with cholera and dysentery proved unsuccessful. Pigs that were fed cultures of *B. suipestifer* sickened and developed diarrhea, but in no case was *B. suipestifer* recovered from the feces, although an organism somewhat resembling it was constantly isolated. The administration of thymol-chenopodium in capsules failed to prove of value in removal of intestinal worms.

In an outbreak of a disease in horses that resembled forage poisoning, in which 16 of 32 horses on a farm died between February 15 and March 2, an organism morphologically similar to *B. botulinus* was obtained from the caecum of one horse, but it did not produce toxin. Botulinus antitoxin of the B type was administered subcutaneously in doses of 40 to 80 cc., repeated in two days, but did not seem to prevent the disease or retard its progress.

The preparation of chicken-pox vaccine was begun early in the year, 1,286 birds in six flocks being tested with satisfactory results. A summary is given of the laboratory diagnoses made during the year, and reference is made to the production of antihog-cholera serum and serum tests and to agglutination and bacterin tests.

Work of the live stock sanitary board, W. A. McRae (*Fla. Dept. Agr. Bien. Rpt., 16 (1919–20), pp. 23–39, figs. 5*).—This report deals particularly with tick eradication and hog cholera control work.

Biennial report of the State veterinarian of the State of Wyoming, B. F. Davis (*Wyo. State Vet. Bien. Rpt., 1918–20, pp. 31*).—Work with infectious diseases from September 30, 1918, to September 30, 1920, is reported upon, particular attention being given to tuberculosis and its eradication through the accredited-herd plan.

[Report of the] veterinary division, S. Youngberg (*[Philippine] Bur. Agr. Ann. Rpt., 1919, pp. 26–36, pls. 5*).—This report deals particularly with control work with rinderpest, of which there were 16,228 new cases during the year and 11,085 deaths recorded. During the year a total of 6,467 cents and carabaos were immunized against rinderpest.

Annual reports of proceedings under the Diseases of Animals Acts, the Markets and Fairs (Weighing of Cattle) Acts, etc., for the years 1917, 1918, and 1919, A. W. Anstruther and S. Stockman (*Bd. Agr. and Fisheries [London], [Vet. Dept.], Ann. Rpts. Proc. 1917, pp. 26; 1918, pp. 30; Min. Agr. and Fisheries [London], [Vet. Dept.], Ann. Rpts. Proc. 1919, pp. 74, fig. 1*).—These are the usual annual reports on the occurence of and work with infectious diseases and parasites of live stock (E. S. R., 37, p. 779). The outbreaks and control work with foot-and-mouth disease are discussed at considerable length in the report for the year 1919.

Annual report of the civil veterinary department, Bihar and Orissa, for the year 1919–20, D. Quinlan (*Bihar and Orissa Civ. Vet. Dept. Ann. Rpt., 1919–20, pp. [4]+8+XIV+2, pl. 1*).—This is the usual annual report (E. S. R., 42, p. 675).

Further observations on the standardization of bacterial suspensions, H. C. Brown (*Indian Jour. Med. Research, 7 (1919), No. 1, pp. 238–250*).—Attention is called to the discrepancy in the results obtained when using different recognized methods for estimating the number of organisms in a bacterial suspension, and a further description is given of a method previously recommended by Brown and Kirwan[3] of standardization by means of opacity tubes. This consists in a comparison of a suspension of the organism with standard suspensions of barium hydroxid.

A series of observations is reported showing that the opacity of a bacterial suspension is proportional to the weight of dried bacterial protoplasm contained in it. A table is also given showing the relation of opacity to the weight and numerical equivalents of various bacteria. The technique of preparing the standard tubes and of standardizing and preparing actual doses of vaccines by this method is described in detail.

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[3] Indian Jour. Med. Research, 2 (1915), No. 3, pp. 763–769.

Preservation of stock cultures of bacteria by freezing and drying, H. F. Swift (*Jour. Expt. Med., 33 (1921), No. 1, pp. 69–75, fig. 1*).—Experience with the method of preserving stock cultures of bacteria by freezing and drying has shown that the viability of the organisms can be correlated with the physical state of the dried material, and that success with this method depends upon maintaining a frozen state until drying is complete. This has been accomplished in the method described by immersing the tubes containing the frozen culture in glycerin in a vacuum desiccator surrounded by salt and ice. After the proper degree of vacuum has been obtained the whole apparatus is placed in the ice box and left for about 12 hours, or until desiccation is complete, after which the tubes are removed from the desiccator, the cotton stoppers pushed down, and the tops sealed with melted paraffin. The properly dried culture is said to be very light and spongy, resembling dried lather from shaving soap.

Magnesium sulphate in arsenic poisoning, O. S. Hansen (*Jour. Pharmacol. and Expt. Ther., 17 (1921), No. 2, pp. 105–113, fig. 1*).—While definite conclusions can not be drawn regarding the action of magnesium sulphate in arsenic poisoning, the author's work has led to the following summary:

"Magnesium sulphate has prolonged the average life of a series of 50 rabbits poisoned by arsenic from 219 hours to 415 hours on the average, but can not be said to have saved life in rabbits. Magnesium sulphate is toxic in large doses and to some extent in medium-sized doses. There is a marked variation of individual susceptibility to arsenic poisoning."

Poisonous properties of the whorled milkweeds Asclepias pumila and A. verticillata geyeri, C. D. Marsh and A. B. Clawson (*U. S. Dept. Agr. Bul. 942 (1921), pp. 14, pls. 3, figs. 2*).—The species of milkweed here considered, which have been found to possess poisonous properties, are closely related to the whorled milkweed (*A. galioides*), a bulletin relating to which has been noted (E. S. R., 43, p. 470). The present bulletin summarizes the results of experimental work on these two milkweeds. The work has shown *A. pumila* to be about one-third as toxic as the very poisonous *A. galioides*, and *A. verticillata geyeri* about one-tenth as toxic as *A. galioides*.

A. pumila, the low whorled milkweed, is found in adobe draws, in dry plains, and in foothills from southeastern Montana and southwestern North Dakota to the Texas Panhandle and central New Mexico, being most abundant on the plains of Colorado. It is usually scattered in small patches in draws. In feeding experiments, the smallest quantity which produced intoxication was 0.787 lb. per 100 lbs of animal, and the smallest quantity that produced death 2.165 lbs. per 100 lbs. of animal. The most prominent symptom in all the cases of poisoning was a weakness of the hind quarters of the animals, which resulted in a staggering gait. There was in most of the cases depression and in some evident trembling, but the staggering was universally present and was particularly noticeable. The pulse generally was weak and rapid, and the animals which were quite sick frequently accompanied the expirations with a grunt or a groan. In the cases which recovered there was no bloating, salivation, or spasm. In the animals which were fatally poisoned, in addition to the symptoms mentioned, there was some bloating and salivation, and they exhibited violent spasms, accompanied with running movements. In two fatal cases the temperature of the sheep reached a maximum of 107 and 109.6° F., respectively. The symptoms continued from a minimum of 7.5 hours to a maximum of 5 days. Of the two animals that died, death followed in 32 and 38 hours, respectively.

A. verticillata, the whorled milkweed of the eastern part of the United States, is distributed throughout the Atlantic Plains and the Mississippi Valley. It differs materially from *A. galioides*, *A. pumila*, and *A. mexicana* in that it has long, fibrous roots and smooth pods. *A. verticillata geyeri* can be distinguished from the typical form by its numerous adventitious buds on the fibrous roots. In feeding experiments with 10 sheep, 2.205 lbs. of leaves and stems was found to be very close to the toxic dose. With the leaves alone 1.286 lbs. was a toxic dose. In the very sick sheep "all the typical symptoms of *A. galioides* were noted, including weakness, especially marked in the hind legs, staggering, weak and rapid pulse, labored respiration (the expirations accompanied with groans), dilated pupils, elevated temperature, bloating, spasms with opisthotonos, and running movements. Spasmodic movements of the mandibles in a chewing movement were very noticeable." The average time before the symptoms appeared was 16 hours 47 minutes, and the average duration of the symptoms was 4.5 and 4.75 hours, with a minimum of 1 hour and a maximum of 11 hours.

It is pointed out that, while as stock-poisoning plants these two species have no history, there is reason to believe that if grazing animals were closely confined to them, injurious results would follow.

Poisoning of cattle by feeding on ergotized paspalum, D. T. Mitchell (*Feedingstuffs, 38 (1921), No. 3, pp. 46, 47, 49*).—This paper reports on the loss caused in the Province of Natal by feeding on grasses infected by a fungus identified by I. B. P. Evans as *Claviceps paspali*.

Hydrocyanic acid in Sudan grass and its effect on cattle, C. O. Swanson (*Jour. Amer. Soc. Agron., 13 (1921), No. 1, pp. 33–36*).—This preliminary report of work at the Kansas Experiment Station is summarized as follows:

"Hydrocyanic acid was found in large amounts in Sudan grass used for pasture, and no harm resulted to the cattle. Liberation of hydrocyanic acid from Sudan grass is apparently associated with enzym action. Digesting in water at room temperature for several hours and then distilling gave larger amounts of hydrocyanic acid than if sulphuric acid was added at once. Hot water and dry heat diminished the amount of hydrocyanic acid obtained. Slow drying caused the hydrocyanic acid to disappear. Tests made on wilted samples or those several days old may be worthless.

"Making Sudan grass into silage did not diminish the amount of hydrocyanic acid obtained. Tests made immediately on frosted Sudan grass gave very large amounts of hydrocyanic acid, but it disappeared rapidly as soon as the plant began to wilt; when dry the hydrocyanic acid had disappeared. While Sudan grass giving a strong test for hydrocyanic acid was not harmful to cattle, under other conditions it was harmful. Immunity was not due to habituation."

Epizootic abortion, V. Robin (*Rev. Vét.* [*Toulouse*], *73 (1921), Nos. 1, pp. 1–17; 2, pp. 65–76*).—This is a general review of the subject as related to the cow, horse, sheep, and pig, discussed in connection with references to the literature.

Researches on infectious abortion in mares, M. Carpano (*Ann. Ig.* [*Rome*], *29 (1919), No. 11, pp. 752–779*).—The author reviews the literature on infectious abortion in mares and joint-ill or arthritis in foals and reports the results of his study of this disease in Italy, where abortions in mares, particularly the imported stock, are quite common and the foals born alive in localities where abortions have occurred are often affected with polyarthritis.

Two microorganisms have been isolated from pathological cases, *Bacillus abortus equi* and a micrococcus of the type of *Streptococcus equi*, the former being considered the causative agent. The characteristics of these organisms are described and successful experiments are reported on the diagnosis of the disease by serum agglutination and on the therapeutic and prophylactic treatment of the disease with a mixed polyvalent serum.

Further studies on the etiological rôle of Vibrio fetus, T. Smith, R. B. Little, and M. S. Taylor (*Jour. Expt. Med., 32 (1920), No. 6, pp. 683–689*).—Previous studies on the etiological rôle of *V. fetus* (E. S. R., 41, p. 779) are supplemented by the reports of three cases of abortion among native heifers, in which the absence of *Bacillus abortus* and the presence of *V. fetus* were definitely proved.

The peculiar distribution of abortions due to *V. fetus*, first among older cows and later in the young stock in the herd studied, is attributed to the fact that the heifers during the first pregnancy were segregated from the purchased cows and were thus kept away from the Vibrio carriers until after the first calving. The fact that the number of cases of vibrionic abortion declined during a period in which cases due to *B. abortus* continued undiminished is thought to indicate that natural immunization of a herd to *V. fetus* proceeds quite rapidly. "Another outbreak may be expected when the immunity of the herd has declined in the absence of the infecting agent and the latter is reintroduced from without, or it may reappear at any time when a Vibrio of higher virulence is brought in."

Experience with the Ascoli precipitin reaction for the detection of anthrax, R. Reinhardt (*Monatsh. Prakt. Tierheilk., 31 (1920), No. 5–6, pp. 268–275*).—A study is reported of the comparative value of microscopic investigation, cultural methods, animal inoculation, and the precipitin reaction of Ascoli (E. S. R., 26, p. 375) for the detection of anthrax in animal carcasses. The results reported are thought to indicate the superiority of the precipitin test, particularly in the detection of anthrax in badly decomposed material.

Immunization against blackleg with germ-free filtrates, E. Gräub and W. Zschokke (*Schweiz. Arch. Tierheilk., 62 (1920), Nos. 2, pp. 52–65; 3, pp. 112–122*).—From a series of experiments on the immunization of guinea pigs, sheep, and cattle against blackleg, the authors conclude that a single subcutaneous injection of blackleg filtrate produces an immunity which protects the animals against double the ordinary fatal dose of virulent blackleg material. A second inoculation with attenuated virus which is not fatal to normal animals, but in itself produces only slight immunity, greatly increases the immunity produced by the filtrate. It is considered that the immunity is not only active and lasting against the strain used for the preparation of the filtrate but against other strains as well.

In practice, the single immunization with blackleg filtrate is recommended for cattle which are exposed to blackleg infection only during the pasture season and the double method for animals continually exposed to infection. Inoculation with the virus should be given not earlier than 10 days nor later than two months after the filtrate inoculation.

Chemotherapy and chemoprophylaxis of foot-and-mouth disease, P. Serena and F. Kuoni (*Schweiz. Arch. Tierheilk., 62 (1920), No. 2, pp. 65–73; abs. in Rev. Gén. Méd. Vét., 29 (1920), No. 341, pp. 259–261*).—The authors report an extensive series of studies on the effect of trypan blue on foot-and-mouth disease in various stages of its development. From 2.5 to 16 gm. of the dye dissolved in from 200 to 400 gm. of boiled water was injected subcutaneously into the side of the neck. The absorption of the dye took place rapidly, and the color persisted for some time at the site of the injection.

The effects of trypan blue upon animals with clinical symptoms are said to be very marked, including rapid lowering of temperature, disappearance of local lesions, and cicatrization of ruptured vesicles. In animals with high fever, but showing no local symptoms, the results were also very striking, local lesions seldom appearing. The authors are of the opinion that chemotherapy is destined to play a considerable rôle in the struggle against foot-and-mouth disease.

The measures taken by Switzerland in recent years for the control of foot-and-mouth disease, L. PLANISSET (*Rev. Gén. Méd. Vét., 30 (1921), No. 349, pp. 1–12*).—This is a brief account in which control measures are considered under the headings of general slaughter, sanitary measures, and treatment with blood of animals recovered from the disease.

Observations on the intrapalpebral test for glanders, W. F. GUARD (*Vet. Alumni Quart.* [*Ohio State Univ.*], *8 (1920), No. 2, pp. 45–51*).—The author discusses the intrapalpebral test for glanders from experience in its use in the American Expeditionary Forces from June, 1918, to May, 1919. The rules adopted in February, 1919, for the application and interpretation of the test are given in full, together with a table representing what was finally considered a fair and practical guide for interpreting the test.

Statistics are given of the number of animals tested and the number of reactors found during certain periods in all the organizations of the Third Army and of the report of the First Division alone during this period. These statistics show a decided falling off in the number of reactions after the second test and the total disappearance of the disease after 3 or 4 weeks. While the animals were tested every 20 or 30 days, the author is of the opinion that the elimination of the infection would be hastened by repeating the test at 10-day intervals.

Rinderpest in Belgium (*Rev. Gén. Méd. Vét., 29 (1920), No. 347, pp. 577–583*).—This is an account of the introduction of rinderpest into and its occurrence in Belgium, reference to which has been previously noted (E. S. R., 44, p. 680).

Bacillary infection and tuberculosis in man and in animals, A. CALMETTE (*L'Infection Bacillaire et la Tuberculose chez l'Homme et chez les Animaux. Paris: Masson & Co., 1920, pp. VI+619, pls. 25, figs. 31*).—The author of this very complete treatise on tuberculosis states that it has been his aim to disengage from the more important of the large number of contributions to this subject and from his own researches, covering a period of many years, the scientific principles upon which must be based the struggle against tuberculosis. The first part, following a brief historical introduction, deals with the general phases of tubercular processes, including the morphology, culture, isolation, and chemical constitution of the tubercle bacillus and the influence of physical and chemical agents upon it, tuberculins, histogenesis, and evolution of the tubercle and bacillary lesions without tuberculous follicles, principal anatomical-pathological types of infection, mechanism of infections through various routes, characteristics of the disease in young and old and in various localizations, and rôle of heredity in the transmission of the disease.

Part 2 deals with experimental tuberculosis and tuberculosis infection in animals, including chapters on different methods of experimental inoculation and infection, differential characteristics of the human and bovine types of tuberculosis, the special characteristics, frequency, and geographical distribution of bovine tuberculosis, specific reactions for its diagnosis, the rôle of bovine tuberculosis in the question of human infection, tuberculous infection in other mammals, in birds, and in cold-blooded animals, and a final chapter on pseudo or paratuberculous acid-resistant bacilli. In part 3 the author discusses the various processes of defense of the organisms against tuberculous infection and the diagnosis of the disease by examination of excretions and by various modifications of the tuberculin reaction.

The fourth and final part deals with natural immunity and the processes of immunization against tuberculous infection. In the concluding chapter, on the scientific principles which must serve as the basis of antituberculous prophylaxis, the author states that in his opinion the only hope of limiting and finally exterminating the disease is in the vaccination of all susceptible human beings and animals by some such method of the use of attenuated bacilli as has been previously tested with animals (E. S. R., 44, p. 780).

The book is profusely illustrated throughout with colored plates of tuberculous lesions both in man and in animals.

The nodular worm and the lesions caused by it (Oesophagostomum columbianum Curt.), A. THEILER (*Union So. Africa, Dept. Agr. Jour., 2 (1921), No. 1, pp. 44–51, figs. 2*).—An account of this worm and its injury to lambs and sheep in South Africa.

Studies on the sheep stomach worm, Haemonchus contortus, J. E. GUBERLET (*Abs. in Anat. Rec., 20 (1921), No. 2, p. 209*).—In studies conducted at the Oklahoma Experiment Station several hundred sheep were treated for the removal of stomach worms. "Copper sulphate in a 1 per cent solution, at the rate of 50 cc. for lambs under one year and 100 cc. for sheep over one year, was found to be 75 to 95 per cent effective. A solution containing 1 per cent copper sulphate and 1 per cent tobacco infusion was found to have an efficiency of 90 to 100 per cent. Cacodylate of sodium was injected intramuscularly at the rate of 7 grains for an adult sheep. Two or three injections were made at intervals of two or three days with only negative results."

It is pointed out that "an estimate can be made of the number of stomach worms in the host from the number of eggs in the droppings. Under normal conditions the number of eggs in a gram of fresh droppings corresponds fairly well with the number of adult female worms in the host. There seems to be from one and one-half to two times as many females as males. Hence, the number of eggs in a gram of fresh droppings, plus one-half to one times that number, gives a fair estimate of the number of adult worms in the host."

Swine practice, A. T. KINSLEY (*Chicago: Amer. Vet. Pub. Co., 1921, pp. 374, pls. 4, figs. 111*).—This is a revised and enlarged edition of the author's Swine Diseases, previously noted (E. S. R., 32, p. 378).

A blackleg- and bradsot-like disease of swine, J. KÖVES (*Centbl. Bakt. [etc.], 1. Abt., Orig., 80 (1917), No. 1-3, pp. 40–65, pls. 5*).—This is a contribution from the bacteriological laboratory of the hog cholera serum plant at Budapest, where a study has been made of the types of anaerobic spore-bearing bacteria occurring in swine. The details are given of studies of the morphology and cultural characteristics of anaerobes obtained from 26 hogs during a period of five years. The diseased conditions present in these animals are recognized by the author as falling into two groups, (1) those found in subcutaneous or muscle tissues, which resemble lesions occurring in blackleg disease in cattle, and (2) those in which the lesions are localized in the stomach, resembling the bradsot disease of sheep. An anaerobic spore-producing organism, isolated from all the cases, was compared with the blackleg bacillus, the malignant edema bacillus, and the Ghon Sachs baccillus.

A list is given of 29 references to the literature.

Effects of X-rays on trichinae, B. SCHWARTZ (*Jour. Agr. Research [U. S.], 20 (1921), No. 11, pp. 845–854*).—Five series of experiments conducted with a view to determine whether X-rays exert deleterious influences on *Trichinella spiralis*, with a further view to the practical application of X-ray radiation to the destruction of trichinae in pork are reported upon. The results are summarized as follows:

"Encysted trichinae are injured by relatively heavy dosages of X-rays. So far as has been determined, the injuries are not visible in the encysted or artificially decapsuled larvae as structural or functional disturbances, but become apparent only when the larvae reach a suitable host animal in whose intestine they are normally capable of continuing their development. Trichinae from meat that has been exposed to strong dosages of X-rays undergo rapid granular degeneration in the intestines of suitable hosts before they attain maturity.

"Encysted larvae that have been exposed to lower but still injurious dosages of X-rays are able to continue development in the intestines of suitable hosts. Such larvae, however, do not attain structural and functional sex maturity. The sex cells appear to be atrophied, and no evidence of successful copulation can be found. X-rays, therefore, appear to exert a more or less selective action on the gonads of trichinae.

"Trichinae appear to exhibit considerable variation in their susceptibility to X-rays, since certain dosages injured some parasites and failed to injure others. Whether the apparent variation in susceptibility of trichinae to X-rays is an expression of an actual physiological variation or may be accounted for by other factors has not been determined.

"The experiments described in this paper do not warrant any definite conclusions as to the feasibility of using X-ray radiation as a practical means of destroying trichinae in pork."

An epizootic of fowl typhoid in France, F. D'Herelle (*Rev. Gén. Méd. Vét., 29 (1920), No. 339, pp. 128–130; abs. in Jour. Compar. Path. and Ther., 33 (1920), No. 3, p. 215*).—The loss occasioned during a series of widespread outbreaks of disease among poultry in France was in a great majority of cases due to fowl typhoid (*Bacterium sanguinarum*), the existence of which had not previously been reported in that country. It is said that in certain places there occurs in coexistence with fowl typhoid another disease of undetermined etiology which causes a high mortality among fowl and geese, the latter of which are not susceptible to fowl typhoid.

Common chick diseases, W. T. Johnson (*Washington Sta., West Wash. Sta. Mo. Bul., 9 (1921), No. 1, pp. 11–14*).—This is a popular summary of information on the subject. The author considers 20 per cent loss up to the time of laying, or about five or six months of age, to be a conservative estimate.

Babesia canis and Haemogregarina canis in the south of France, E. Pringault (*Compt. Rend. Soc. Biol. [Paris], 83 (1920), No. 33, p. 1444*).—In the course of investigations of canine leishmaniosis the author has met with *B. canis* and *H. canis* in the blood of dogs. In examinations of 367 dogs from 1913 to 1917, 5.88 per cent were parasitized by *B. canis* and 0.81 per cent by *H. canis*. Canine piroplasmosis was found to be most frequent in summer when it averaged 2.23 per cent, and lowest in winter when it reached an average of 0.56 per cent. *H. canis* was observed three times, twice in July and once in August.

Some common parasitic worms occurring in the domesticated animals in South Africa, E. M. Robinson (*So. African Jour. Nat. Hist., 2 (1920), No. 2, pp. 277–279*).—This is a brief account of some of the more important endoparasites of domestic animals.

RURAL ENGINEERING.

Nineteenth annual report of the Reclamation Service, 1919–20, A. P. Davis (*[U. S.] Reclam. Serv. Ann. Rpt., 19 (1920), pp. 589, fig. 1*).—This report relates in particular to the work completed and in progress during the fiscal year ended June 30, 1920, and also contains information in regard to previous operations for explanatory purposes and to indicate progress.

On June 30, 1920, the net cost of construction of the reclamation projects amounted to a little less than $125,000,000. The value of crops grown in 1919 on lands served either in whole or in part from the works of the service amounted to nearly $153,000,000, about $89,000,000 of which represents the value of crops grown on the 1,113,469 acres of cropped land on the projects proper, from which definite crop statistics are secured, or $79.88 per acre, and the balance an estimated amount from approximately 1,000,000 acres of land served with water under the Warren Act from the works of the service. The projects already completed or under way will ultimately comprise an area of over 3,300,000 acres.

Review of the work of the irrigation department, Central Provinces, for the year 1919–20, S. G. RIVETT-CARNAC (*Cent. Provs. [and Berar, India], Irrig. Dept. Rev., 1919–20, pp. [1]+15*).—This report deals with the work and expenditures of the irrigation department of the Central Provinces of India for the fiscal year 1919–20.

Factors determining the duty of water in irrigation, J. T. KINGDON (*Engin. News-Rec., 86 (1921), No. 13, pp. 546, 547*).—A list of the various and interrelated factors determining the use of water in irrigation is given, which has been prepared for use in court cases. It is considered useful as a guide in the analysis of conditions on new projects and for the improvement of conditions on projects already in operation.

Surface water supply of New Mexico, 1919–1920, L. A. GILLETT (*Santa Fe, N. Mex.: State Engin. Dept., 1919–20, pp. 184*).—This report presents the results of measurements of flow made on streams in New Mexico during the calendar year 1919 and up to and including September 30, 1920. Data on evaporation from water surfaces are also included.

Farm drainage for larger and better crops, H. B. ROE and G. R. B. ELLIOTT (*Minn. Farmers' Inst. Ann. No. 33 (1920), pp. 61–90, figs. 32*).—A large amount of practical information on land drainage as it is practiced in the State of Minnesota is given, as a contribution from the University of Minnesota.

Power applied to agriculture.—II, Water power, W. H. S. CLEGHORNE (*So. African Jour. Indus., 3 (1920), No. 7, pp. 588–596, pl. 1, figs. 4*).—In a second contribution to the subject (E. S. R., 43, p. 591), the author deals with the development of water power for farm use, describes the overshot wheel, the Francis turbine, and the Pelton wheel, and also deals with pipe lines and supply dams.

Investigations of road subgrades, A. T. GOLDBECK (*Jour. Soc. Automotive Engin., 8 (1921), No. 4, pp. 339–346, figs. 7*).—A review is given of work finished and in progress on the investigation of road subgrades, especially that conducted by the Bureau of Public Roads of the U. S. Department of Agriculture.

Biennial report of the Department of Highways, 1919–1920, J. M. LEONARD ET AL. (*Nev. State Dept. Highways Bien. Rpt., 1919–20, pp. 144, figs. 51*).—Data on the work and expenditures of the Nevada Department of Highways on the construction of the State highway system for the period from January 1, 1919, to November 30, 1920, are contained in this report.

Fourth biennial report of the Oregon State Highway Commission covering the period December 1, 1918, to November 30, 1920, R. A. BOOTH ET AL. (*Oreg. State Highway Comm. Bien. Rpt., 4 (1918–1920), pp. IV+425, pls. 49*).—Data on the work and expenditures of the Oregon State Highway Commission and of the office of the State highway engineer for the biennium ended November 30, 1920, are contained in this report.

Dust explosions: Cause, effect, and prevention, D. J. PRICE (*Engin. News-Rec., 86 (1921), No. 15, pp. 634–636, figs. 3*).—A brief review is given of some of the work of the U. S. Department of Agriculture on the cause, effect, and prevention of dust explosions.

Ignition temperatures resulting in explosion were determined as 2,363° F. for wheat elevator dust, 2,300° for flour, 1,821° for oats and corn elevator dust, 1,868° for oats hull dust, and 1,877° for yellow corn dust. Limited tests indicate that the velocity through a cloud of wheat flour dust is practically the same as through coal dust, and that through a cloud of powdered starch it is several times as rapid.

Tests conducted in cooperation with the U. S. Bureau of Mines showed that the following explosion pressures in pounds per square inch were developed: Lycopodium 17.5, wheat smut dust 15.9, yellow corn 15.2, dextrin 14.6, tan bark 13.3, wheat elevator dust 13, wood dust 12.8, corn starch 12.7, sugar 12.2, potato flour 11.7, fertilizer 10.5, coal (Pittsburgh) 10.1, cocoa 9.1, sulphur 8.8, and cork 7.4. From the know chemical composition of flour and a calculation of the approximate mechanical work which a given mass of flour can perform, it has been found that the contents of an ordinary sack, when mixed with 4,000 cu. ft. of air, will generate force enough to throw 2,500 tons mass to a height of 100 ft.

It is considered reasonable to conclude that the dust explosion hazard is greater during periods of continued low humidity. Possible changes in construction and the installation of mechanical equipment suggested by recent explosions are discussed. Among these, the prevention of the generation of high pressures by the use of thin walls offering little resistance to explosion pressures is suggested.

The kiln drying of lumber, H. D. Tiemann (*Philadelphia and London: J. B. Lippincott Co., 1920, 3. ed., pp. XI+318, pls. 31, figs. 40*).—This is the third edition of this book (E. S. R., 38, p. 46).

The carburetion of alcohol, A. W. Scarratt (*Jour. Soc. Automotive Engin., 8 (1921), No. 4, pp. 328–330, figs. 2*).—The results of experimental work in the development of a tractor engine that will burn alcohol are reported.

Using a 4½ by 6 in., 4-cylinder, 16-valve engine, it was found that the best compression was 110 lbs. per square inch. The use of the entire exhaust heat for heating the fuel charge was found to be necessary. The temperature of the ingoing charge of fuel for good carburetion and economical operation should not be less than 100° F. The intake-manifold should be designed to obtain uniform distribution, and the intake-manifold gas velocity at full load should not be less than 9,500 ft. per minute on the average.

Starting difficulties were increased when burning alcohol, but satisfactory starting was accomplished by a redesign of the starting crank, together with the use of a mixture of four parts of alcohol to one of gasoline.

Belgian experiments on palm oil as motor fuel (*Chem. and Metall. Engin., 24 (1921), No. 9, pp. 400, 401*).—A series of experiments begun in 1914 and now in progress on the use of palm oil as a fuel for internal-combustion engines is briefly described.

It is stated that the calorific power of palm oil is from 20 to 25 per cent less than that of crude oil, and that it fuses at a comparatively high temperature (37° C.). Complete combustion was found to be necessary to the satisfactory utilization of palm oil. After starting and warming up on crude oil several engines ran smoothly on palm oil. The oil neither clogged the motors nor left any perceptible solid residue.

Analyses are said to show that palm oil is a mixture of palmitate and oleate of glycerin, with some variable quantities of palmitic and oleic acid. It contains about 95 per cent of fatty acids and appears as a pasty substance of yellowish or salmon color. Its calorific power is estimated at 9,228 calories, and it is flammable at 210°.

The Nebraska tractor tests, O. W. Sjogren et al. (*Nebraska Sta. Bul. 177 (1921), pp. 14, fig. 1*).—This bulletin enumerates the provisions and objects of the Nebraska tractor testing law (E. S. R., 42, p. 784), describes the tests imposed and the apparatus used, and summarizes the data contained in the reports of tests conducted in 1920. The tests covered 69 different tractors of about 38 makes. Some of the details of these tests have been noted in the *Record* from time to time.

Farm mechanics (*Indiana Sta. Rpt. 1920, p. 24*).—Tractor tests to determine actual ratings showed that the angle iron cleat wheel equipment commonly used permitted as high as 40 per cent slippage on a 2 plow tractor between normal and no load. In dry soil the sequence of cuts made by the angles resulted in a series of earth blocks cut loose, which moved back when the thrust of the tractor came against them. The disturbance of the soil was extreme, causing unnecessary strains to be thrown on the mechanism of the tractor by constant jerking. The effects of the angles were not nearly so pronounced on damp plastic soil.

Best results were obtained with a thin spade about 3 in. square. Only 3 per cent slippage was observed with these. The conclusion is drawn that the best type of lug is that which enters and leaves the ground with the least disturbance. The staggered spade lug was the best in this respect.

How the tractor saves time, C. H. Sprague (*Tractor and Gas Engine Rev., 14 (1921), No. 3, pp. 7, 49, figs. 3*).—Graphic data are presented on the time required to plow, till, plant, and harvest 30 acres of wheat with a tractor and with horses. It is shown that about one-fourth the time was necessary to do the work by tractor as by horses, and it is pointed out that the tractor because of its extra power was able to plow deeper and make a better seed bed.

I, Working tests of straw presses, packers, and carriers. II, Individual and new tests, and other investigations, A. Christensen (*Statens Redsk. Prøver, Beret. 21 (1919), pp. 91, figs. 23*).—Comparative tests of 10 different commercial makes of straw presses, packers, cutters, and carriers are reported and discussed, together with special individual tests of different apparatus, such as a potato digger, lubricators, paper-binding twine, and different commercial makes of farm engines and motor plows.

Studies on corn-harvesting machinery, M. Conti (*Rev. Facult. Agron. y Vet., Buenos Aires, 3 (1920), No. 1, pp. 25–32, figs. 4*).—Two corn harvesters developed after three years' study at the Experimental Institute of Agricultural Mechanics at Buenos Aires are described.

One machine is adapted for the cutting of green corn for silage, and consists of an inclined knife between forked iron frame parts which receive and cut the standing corn, allowing it to fall on a platform where it is properly loaded. Two men and three horses are required.

The second machine is adapted for the harvesting of dry corn and also requires two men and three horses. The knife is a circular saw-edged type, revolving at between 180 and 200 r. p. m., and is actuated by a wheel on the ground. Both machines are said to have been satisfactory under test.

The twist drill: Making it fulfill great expectations, H. Wills (*Tractor and Gas Engine Rev., 14 (1921), No. 3, pp. 10, 11, 48, figs. 14*).—Data and information on the proper use and maintenance of twist drills, with particular reference to the repair of farm machinery, are given.

Farm buildings, F. C. Lewis (*Indiana Sta. Circ. 100 (1921), pp. 144, figs. 130*).—The purpose of this circular is to offer suggestions on the planning and construction of farm buildings, including dwellings, barns, hog and poultry houses, workshops, and other buildings. It is based upon a study of farm-building practice in Indiana and neighboring States. Plan and detail drawings of the different structures are given, together with considerable working data.

Domestic architecture, L. E. Robinson (*New York: Macmillan Co., 1917, pp. XIII+378, figs. 50*).—Part 1 of this book is a text intended for use in teaching the subject of the house in colleges and in schools of home economics. It is devoted to a consideration of house design and construction, the cost of dwellings, and such related topics as the selection and development of the site, and, to some extent, of the equipment and decoration of the interior. Chapters are included on the history of domestic architecture, domestic architecture in the United States, and the practice of architecture. Sketch problems are appended to each chapter.

Part 2 is a practical guide for house design, consisting of a drafting-room manual, problems in design, and a glossary of architectural terms.

Conveniences in the home, J. L. SHEPPERD (*Minn. Farmers' Inst. Ann. No. 33 (1920), pp. 138–148, figs. 11*).—General drawings and practical information are given for installing what are considered to be cheap and serviceable water-supply systems for farm homes. These include also information on cisterns.

The septic tank—a method of sewage disposal for the isolated home, H. E. MURDOCK (*Montana Sta. Bul. 137 (1920), pp. 27, figs. 14*).—A progress report is presented on studies begun in 1915 at the station with three different types of sewage-treatment tanks and disposal areas, together with general information regarding results obtained from miscellaneous installations in the neighborhood.

The tanks included (1) a single-chamber septic tank 3 ft. wide, 7 ft. 10 in. long, and 3 ft. deep; (2) a double-chamber septic tank with digestion chamber 2 ft. wide, 5 ft. long, and 4½ ft. deep, and a discharge chamber fitted with an automatic siphon; and (3) a modified Imhoff tank 3 ft. 4 in. wide, 4 ft. 4 in. long, and 14 ft. deep at one side and 16 ft. deep at the other. All three tanks are provided with sludge outlets and with inlets entering below the sewage line. No definite data are given regarding the nature and amount of the sewage treated or the basis of design of the tanks. However, it is noted that during four winter seasons the sewage flow to the tank varied widely in nature and amount and was discontinued for considerable periods from time to time.

After the four seasons it was found that approximately the same amount of scum was on the surface of each tank. It appeared that the septic action and the deposition of sludge were practically the same in the three tanks. There was very little sludge deposition, and apparently septic action was good in all three tanks in spite of the variable conditions of service imposed.

The disposal areas were operated at a depth of 14 in. in light soil and were apparently little hindered by long periods of zero weather. They cared for the sewage effluent satisfactorily.

On account of the simplicity, ease of construction, and comparatively low cost of the single-chamber tank it is recommended for isolated homes.

The studies are being continued.

Surface purification of sewage, W. D. SCOULLER (*Surveyor and Munic. and County Engin., 58 (1920), No. 1511, pp. 447, 448*).—Studies on the various stages in the purification of sewage passing through a percolating filter are reported. An inclined galvanized tube 8 ft. long and 6 in. in diameter, containing 1 in. clinker obtained partly from a mature filter, was first used, settled sewage being dripped in at the upper end. To increase the length a surface 34 ft. long, made of half iron pipes 3½ in. in diameter, was also used.

It was found that "when sewage is passed over a surface in presence of air the organic matter is gradually deposited and forms a tenacious slime. The organic matter first deposited is that kind which gives rise to sulphureted hydrogen when fermented anaerobically. The slime has the property of withdrawing colloidal matter from sewage and acts also as a reducing agent. Disintegration of the slime began 10 weeks after starting the experiment and coincided with the appearance of small worms. At the same time nitrification set in. Oxidation thus appears to be related to slime disintegration.

"Nitrification was never noticed after the sewage traveled 10 ft., and probably could not take place in the first 10 ft., because of the thickness of the slime. The free and saline ammonia which disappears from the settled sewage was not all recovered as oxidized nitrogen in the effluent.

"The purification of sewage depends on the rate of treatment, or, in other words, varies with the surface used. A coarse filter is usually constructed with large material at the bottom, and graduated so that finer material is on the surface. The reverse process of having large material at the top and finishing with the smaller material below the center would probably prove more efficient."

Studies on the process of removal of sulphureted hydrogen from tank effluent by filters using the same apparatus showed that "sulphureted hydrogen (8-10 parts S per 100,000) in a solution of tap-water is mostly absorbed by the slime after traveling 10 ft., when passed over surfaces which have previously been treating sewage, probably as sulphid. Part is converted into sulphate (about 15 per cent), but this is largely increased when the apparatus is resting. A weak solution of sulphureted hydrogen (2 parts S per 100,000) is retained after traveling 10 ft., and nearly all after 4 ft., but it is all recovered by oxidation to sulphate. The slime absorbs sulphate from sewage, but the records are insufficient to show what actually happens to the sulphate."

Formula for determining settling periods in basins or tanks, T. SAVILLE (*Engin. News-Rec., 86 (1921), No. 15, p. 647*).—A formula for calculating settling periods in the treatment of water or sewage for special use where it is desired to determine the settling periods directly for various dimensions of tank without finding the velocity of flow is derived as follows: $S=\frac{7.5\ LAN}{Q}$, in which S=the the settling period in hours, L=length of tank, A=cross-sectional area of tank, N=number of hours during which flow is assumed to occur, and Q=total flow in gallons per day.

Operating a home heating plant, A. M. DANIELS (*U. S. Dept. Agr., Farmers' Bul. 1194 (1921), pp. 28, figs. 8*).—The requirements that should be met in order to heat the home satisfactorily are discussed, and advice is given concerning the selection, installation, and operation of home heating plants.

RURAL ECONOMICS AND SOCIOLOGY.

Preliminary report on farm organization in Twin Falls and Latah Counties, B. HUNTER (*Idaho Sta. Bul. 123 (1921), pp. 11*).—The first of two projects which have been undertaken in this region by the station cooperating with the Office of Farm Management and Farm Economics, of the U. S. Department of Agriculture, for the purpose of studying crop rotation and cropping systems that should be followed as well as the relative profitableness of the different crops and classes of live stock is reported.

Considerable data secured in November and December, 1919, on 200 farms in the vicinity of Twin Falls, Idaho, covering the period from December, 1918, to December, 1919, are presented in detail. The average crop yields per acre for these farms were as follows: Wheat 38 bu., barley 40 bu., potatoes 137 cwt., beans 1,122 lbs., sugar beets 9.2 tons, alfalfa hay (3 cuttings) 3.9 tons, red clover hay (1 cutting) 1.1 ton, red clover seed 286 lbs., and alsike clover seed 318 lbs.

The average number of animal units kept per farm varied from 7 for the group of smallest farms to 21.3 for the group of largest farms. For the 200 farms as a whole, 82 per cent of the receipts were from the sale of crops, 11 per cent from the net increase from live stock, 2 per cent from miscellaneous sources, and 5 per cent from an increase in feed and supplies.

The average expenses ranged from $1,086 for the group of smallest farms to $4,249 for the largest-size group. The percentage of expenses required for labor increased steadily from 22 per cent for the group of smallest farms to 40 per cent for the group of largest farms.

The sum of labor income plus family perquisites, representing the full amount the farmer has left for his labor after allowing 7 per cent for the use of the farm capital, averaged $662 for the group of smallest farms, $537 for the second-size group, $928 for the third, $1,381 for the fourth, and $1,188 for the fifth, the average for the 200 farms being $940.

The average return on the capital of the 200 farms was 7.2 per cent. The group of smallest farms made 6.2 per cent on the average farm investment and the largest 7.3 per cent. The fourth-size group, including the 80-acre farms, made the highest return on capital, while the 40-acre farms made the lowest.

Direct crop labor requirements, the influence of crop yields on the return on capital, and the relation of size of farm to the efficient use of labor and machinery are analyzed and the data tabulated.

Cost data for the sugar beet crop in this region are tabulated on the basis of 44 records and a total of 687 acres of beets. The figures indicate that the total average cost of producing sugar beets in Twin Falls County, Idaho, 1919, the use of land included, was $136.39 per acre and $12.50 per ton. Of the total cost per acre, labor was 54.2 per cent, manure 2.5 per cent, seed 1.7 per cent, water 2.3 per cent, taxes and insurance 2.7 per cent, machinery 5.3 per cent, overhead 6.1 per cent, and land 25.2 per cent. When the use of land was excluded from the cost items, the average costs were $102.10 per acre and $9.36 per ton.

The average yield of beets for the 687 acres was 10.9 tons, the price received per ton was $11, and the margin of profit per acre $22.78. At an average valuation of $442 per acre, a return of 5.15 per cent on the investment was realized.

Some types of irrigation farming in Utah, E. B. Brossard (*Utah Sta. Bul. 177 (1920), pp. 140, figs. 21*).—The original investigation was conducted during 1914, 1915, and 1916 by the author, employed by the U. S. Department of Agriculture and the Utah Experiment Station. Types of farming as reflecting the interrelationships of economic factors were studied from a total 950 farm records for from one to three years in eight areas, including one each in Cache, Salt Lake, Utah, Carbon, Millard, Emery, Sevier, and Beaver Counties. The plan of study enumerates and describes the individual crop and stock enterprises, determines the magnitude and importance of the separate enterprises and combinations and proportions, and analyzes the factors affecting their choice and combination. The Hyde Park area, in Cache County, is treated in considerable detail, the others only briefly.

The farm well planned, D. H. Otis (*Wisconsin Sta. Bul. 328 (1921), pp. 28, figs. 22*).—Recommendations are made for planning the size and shape of fields on 10 typical Wisconsin farms, as well as crop rotations best suited to Wisconsin conditions.

Comparison of rotations, crop costs, and net receipts per acre, H. R. Hoyt (*Ohio Sta. Bul. 344 (1920), pp. 274, 275*).—Comparison is made of rotations on the Paulding County Experiment Farm on the basis of five-year average yield and value per acre, 1915–1919. Labor and miscellaneous costs and net receipts per acre are tabulated for rotations followed on tenth-acre plats.

Cost accounting work, R. R. Barker (*Ohio Sta. Bul. 344 (1920), p. 467*).—From records kept on the Madison County Experiment Farm as to the relative costs, labor costs especially, of growing different crops and of performing different operations, it was found, for instance, that in 1919 it cost $18.59 per acre to cut and husk corn and put the corn and stover into the barn; while it cost $26.24 per acre to put the same kind of corn into the silo. It was found also that 34 man hours and 59 horse hours were required to grow and harvest an acre of corn husked on the stalk, while an acre of oats required 19.5 man hours and 23.5 horse hours for growing and harvesting.

Cost of producing wheat, M. R. Cooper and R. S. Washburn (*U. S. Dept. Agr. Bul. 943 (1921), pp. 59, pls. 2, figs. 9*).—Tabulated cost data derived from 481 records, of which 197 were obtained in five representative counties of the principal spring-wheat States, North and South Dakota and Minnesota, and 284 in nine counties in Kansas, Missouri, and Nebraska, important winter-wheat States, furnish the basis of this analysis of the average cost and variation in cost on individual farms and groups of farms in each area visited, as well as of the more important reasons for the great variations in cost per acre and per bushel on individual farms. A total area of 43,940 acres seeded to winter wheat, yielding 635,124 bu., and a total area of 44,218 acres seeded to spring wheat, with the total production of 362,047 bu. for the crop year 1919, were involved.

The average yield of spring wheat was 9 bu. per acre in the United States as a whole in 1919, and 8.4 bu. per acre for the total spring-wheat area surveyed; the average yield for all winter wheat in 1919 was 14.7 bu. per acre, while that for farms surveyed was 14.9 bu. per acre. The largest number of spring-wheat farms fell within the group having a yield of from 5 to 10 bu. per acre, while the largest number in the winter-wheat districts were included in the group having a yield of from 15 to 20 bu.

The difference between the gross cost and the sum of credits for pasture and any straw utilized on the farm is taken to be the net cost of producing wheat. The average cost expense of each item was computed on a weighted basis by dividing the total cost of each item by the total wheat acreage. An analysis of the total cost for spring and winter wheat shows that labor constitutes about 32 to 35 per cent of the total cost of production, thrashing about 8 per cent, materials from 10 to 17 per cent, land rent from 24 to 30 per cent, and other costs from 17 to 19 per cent.

The average cost of producing winter wheat was $27.80 per acre and $1.87 per bushel as compared with an average cost for spring wheat of $22.40 per acre and $2.65 per bushel. The difference in cost per bushel of producing spring and winter wheat is due to a lack of relation between the cost of producing an acre of wheat and yield obtained, the cost per acre of winter wheat being 24 per cent greater than for spring wheat, whereas the yield per acre was 77 per cent greater. In the spring-wheat area about 33 per cent of the production was on the farms having costs above the average; in the winter-wheat area about 40 per cent of the production was on farms having costs above the average.

Summaries of costs by districts, range in cost per acre by counties, net cost per bushel, variations in items of cost, array of farms according to cost per bushel by counties, cumulative percentage of acreage grown at various bushel cost, cumulative percentage of total production, and individual costs per acre are tabulated and interpreted.

The cost of raising grain, P. S. Goodman (*Amer. Elevator and Grain Trade, 39 (1921), No. 9, pp. 707, 708*).—Certain data derived from an inquiry into the costs of producing the principal crops, made immediately after the 1910 census and published in the *Crop Reporter* of the U. S. Department of Agriculture in

1911, are extended on the basis of annual reports in the same publication of labor costs, average yields, monthly prices of products on the farms, and land values for the years 1916 to 1920, inclusive. The study is carried out with respect to wheat, corn, and oats in the United States as a whole. Corn and oats in Iowa and wheat in Kansas are similarly studied.

Cost of canning Wisconsin peas, T. MACKLIN (*Wisconsin Sta. Bul. 327 (1921), pp. 20, figs. 6*).—A complete analysis of facts submitted by 22 of the 88 Wisconsin pea-canning factories as to the various elements of cost involved in the business indicated that in 1919 the cost of raw peas amounted to 26.4 per cent, cans represented 22.7, boxes 5.2, direct labor 8.7, all other expenses 25.5, and profit before deduction of income taxes 11.5 per cent of the factory selling price of No. 2 size cans of peas.

It is said that over $16,000,000 is invested in land, buildings, and equipment for this industry, $9,000,000 by farmers. About 56,672 acres were devoted to the growing of peas for canning in Wisconsin in 1919, one-fifth of which area was owned and cultivated by pea-canning companies.

The adjustment of the farm business to declining price levels, H. C. TAYLOR (*Jour. Farm Econ., 3 (1921), No. 1, pp. 1–9*).—The points made in this presidential address with regard to the curtailment of expenses of agricultural production and marketing have been previously noted (E. S. R., 44, p. 196). In regard to the problem of agricultural protection, the comment is made that "whether the world conditions are such as to facilitate a world economy or to necessitate a national economy, the American farmer is now in a state of mind to demand protection in the home market for his products. If we are now to enter upon a period of agricultural protection similar to that in England known as the 'Corn Laws' following the Napoleonic Wars, we should study with care the English experience."

Address of Henry C. Wallace, Secretary of Agriculture, before the Farmers' Grain Marketing Committee of Seventeen, Chicago, April 6, 1921 (*County Agent and Farm Bur., April, 1921, pp. 5–7; also in Wallace's Farmer, 46 (1921), No. 15, pp. 642, 643, fig. 1; abridged in U. S. Dept. Agr., Market Rptr., 3 (1921), No. 18, pp. 273, 286*).—The author's conception of the proper function of the Government in furnishing information with regard to the supply and demand, and facilities and cost of marketing, perishable and other farm crops, is set forth. The plan of cooperative marketing evolved by the committee addressed is commended as being founded on practical experience, as being an adjustment of existing systems and not an attempt to create a monopoly or fix a price.

Yearbook of the International Farm Congress (*Yearbook Internatl. Farm Cong., 1920, pp. 175, pls. 6*).—Included in the proceedings of the fifteenth annual session of this body, held at Kansas City, Mo., December 9–11, 1920, are addresses by H. J. Waters and H. C. Taylor, both of whom emphasize from one viewpoint or another the necessity of economy in agricultural production. Other speakers were officers of the congress and men interested in the production and marketing of agricultural products. Resolutions adopted and the constitution of the congress, its history and purposes; a roster of a number of farm organizations; and other items of general information are given.

Food supplies in peace and war, R. H. REW (*New York and London: Longmans, Green & Co., 1920, pp. VII+183*).—A survey is made of the world's food supply in its relation to world consumption. The author concludes that there is no cause for alarm about a general food shortage while the world is at peace. He believes that the actual limit of food production is one of the least serious aspects of the food question.

Special emphasis is given to the situation of Great Britain. The solution of England's problem, according to the author, lies in stimulating the production of materials for export as well as of produce for home consumption. The multiplication of small land holdings to get more men on the land, the bettering of the social and economic conditions of farm workers, and further support by the State of agricultural education and research, are the means suggested for increasing agricultural output.

The British corn trade from the earliest times to the present day, A. Barker (*London and New York: Sir Isaac Pitman & Sons, Ltd., [1921], pp. VIII+132, figs. 10*).—Famine and price fluctuations resulting in England from poor seasons, pestilence, and the perils and limitations of shipping in early English history, and early attempts to legislate against speculation in food grains, are described. Grain prices between 1600 and 1815 are reviewed in some detail as reflecting war and peace and consequent agricultural conditions. The sliding scale of duty on imported grain put into effect by the so-called "Corn Laws" for the protection of the British grower is discussed, and the various evasions resorted to and the opposition aroused are related. The growth and development of the modern corn trade is attributed to the abolition of high protective duties, the development of steam navigation, the growth of British industries, and the increase of urban population, together with the opening up of new wheat lands in western countries. The effects of the recent war and the events leading up to and necessitating the temporary paralysis of British corn trade under government control are set forth.

The present potential grain production in Italy, G. Zattini (*Min. Agr. [Italy], Uffic. Statis. Agr., Not. Period. Statis. Agr., 11 (1920), No. 3, pp. 1–57*).—This article presents a résumé of grain statistics for the period 1909–1920 by years, regions, and provinces, showing maximum and minimum acreages and production. This study does not encourage an attempt to increase grain production. It is shown that the amount produced is at present just about sufficient for the home demand.

Modern agriculture, with special reference to progress in Canada since confederation in 1866, G. C. Creelman (*Jour. Roy. Soc. Arts, 69 (1921), No. 3562 pp. 209–228*).—In these pages there is given a general résumé of census figures, mainly since 1870, with discussion, showing the areas, yields, and values of the principal Canadian crops, numbers of live stock, production of dairy products, and fruit growing and trade. A brief note relates the beginning and development of agricultural education in the provinces. The discussion is contributed to by D. Hall and others.

Agusan: Its natural resources and opportunities for development, P. J. Wester (*Philippine Agr. Rev., 13 (1920), No. 2, pp. 100–111, pls. 6*).—A general description of this region and a report of climatic conditions, population, history, agriculture and food crops, and its commerce and communications are given in this article. Illustrations include maps and photographs of the country showing typical vegetation.

Modern land settlement, G. B. Schell (*Calif. Univ. Jour. Agr., 7 (1921), No. 3, pp. 3–5, 30, figs. 2*).—Certain land colonization projects under private direction, particularly one in the suburbs of Sacramento, Calif., are briefly described.

Agricultural questions (*Geneva: Internatl. Labor Off., 1921, pp. 88*).—Special questionnaires have been drawn up directing the attention of the various governments participating in the third session of the International Labor Conference, to be held at Geneva in October, 1921, to the regulation of agricultural labor. The existing legislation and available information with reference to the adaptation of the resolutions of the Washington conference of November, 1919, to agricultural labor, especially the regulation of the hours of work, means of preventing and providing against unemployment, and the protection of women and children, also on the subjects of technical agricultural education, housing of agricultural workers, the guaranty of the right of association and combination for agricultural workers, and their protection against accident, sickness, invalidity, and old age, are briefly presented in each case preceding the outline list of questions.

Agricultural labor in its international relations (*Ireland Dept. Agr. and Tech. Instr. Jour., 21 (1921), No. 1, pp. 13–17*).—In these pages is offered an extract from the debate in the commission on economic and social policy of the fifth general assembly of the International Institute of Agriculture, on the motion made, in view of the possibility of the application of international labor regulations to farm work, recommending a more thorough study by the institute itself of the economic, juridical, and social conditions of life of agricultural wage earners.

Marketing problems of Minnesota farmers, H. J. Hughes (*Minn. Dept. Agr. Bul. 11 (1920), pp. 23*).—A discussion of the market crops of Minnesota and the particular marketing conditions which they require, together with notes on the rôle of cooperation in this connection, is offered. Certain principles exemplified in an agency for marketing Minnesota potatoes and perishable products are outlined, and their possible application to the marketing of wool, dairy products, live stock, eggs, hay and roughage, grain, and farm timber is suggested.

Farmers' Market Bulletin (*North Carolina Sta., Farmers' Market Bul., 8 (1921), No. 44, pp. 11*).—This number continues the usual monthly list of products which farmers have for sale, with notes on cooperative marketing.

The Market Reporter (*U. S. Dept. Agr., Market Rptr., 3 (1921), Nos. 15, pp. 225–240, fig. 1; 16, pp. 241–256, fig. 1; 17, pp. 257–272; 18, pp. 273–288*).—The usual abstracts of information of domestic movement, imports and exports, prices, and the situation in the market of specified commodities and important classes of agricultural products are given in these numbers, together with analyses of foreign market conditions. Brief special articles on this year's prospective harvest of wheat in India and Rumania appear in Nos. 15 and 16, and in No. 15 there is also an account of live-stock marketing costs with tabulated information relating to maximum and minimum commission charges on various classes of live stock in 1914 and 1921 and yardage charges per head. An investigation of the numbers of cattle to be pastured and pasturage charges in Kansas and neighboring regions is reported on in No. 16. Estimates arrived at on basis of a survey by the Bureau of Markets and from other sources are given in No. 17, indicating the percentage of the marketable surplus of hay sold, and pointing out the extent and causes of present price declines for hay. In No. 18 there is published a portion of the address by Secretary H. C. Wallace, as noted above.

AGRICULTURAL EDUCATION.

Vocational education, D. Snedden (*New York: Macmillan Co., 1920, pp. XI+587*).—This book is devoted primarily to a discussion of current problems in vocational education for the rank and file of workers. The author analyzes the essential factors of the problem and then states his own hypothetical surmises and conclusions. Bibliographies, occupational statistics, and a terminology of vocational education are included.

For the purposes of this book a fundamental distinction is made between (1) direct vocational education, taught by the schools, including only those forms in which training for a specified vocation is the primary, central, and controlling purpose, and in which production, recreation, control, etc., are all regarded as secondary, minor, or incidental purposes; and (2) indirect vocational education, or vocational by-education, which is a by-product of activities designed primarily for other purposes and is taught through apprenticeships on farms, and in homes, shops, offices, mines, etc.

The chapter on vocational education for the agricultural callings discusses the varieties of vocational agricultural education; the home project school; debatable issues with reference to the organization and method of instruction in secondary vocational agriculture as indicated by Eaton (E. S. R., 38, p. 598; 39, p. 797); vocational aims; specialization of function; focal and marginal fields; unsettled problems, such as the acquisition of land, enlarging capital units, and leaving the farm; the project method of teaching agriculture elucidated by a summary of the conditions which ideally might be expected to prevail, together with the vocational pedagogy of aim and method implicit in such conditions; rural schools and vocational education for the farming callings, including findings on the aims of rural school elementary education, rural secondary education, agriculture in general education, and vocational secondary education.

In the author's opinion the greatest practical dangers in the evolution of workable schemes of agricultural education will come from the attempts to train boys to be "farmers" in the general sense, as the "all-round farmer" or general farming fits very poorly into the economy of the twentieth century. Vocational education must follow the specialization produced by economic forces. In framing the plans of vocational education for agricultural schools he would be guided chiefly by the practice of successful modern farmers, distinguishing sharply between their capacities or powers involved in abilities to do, to execute, or to perform, and those involved in abilities to appreciate the need of the services of others and to appraise or evaluate that service when rendered by them. General analyses of different types of farm life in various regions are considered desirable in order that the educative processes may be closely adapted to individual and community needs. The two problems at present found most pressing are the provision of opportunities for practical training for city boys and the problem of combining secondary vocational agricultural education with preparation for higher institutions for the study of agriculture.

Before the agricultural colleges of this country will train qualified teachers of vocational agriculture effectively, the author believes two antagonistic conditions will have to be overcome. The actual requirements of successful vocational education for the agricultural vocations must be defined, formulated, and made a matter of demonstration, and the college authorities and the other related agencies of scientific agriculture must become convinced that there is a place, and a large place, for vocational education in agriculture below the level of the college. This problem may be simplified when American secondary education in its administration shall refuse to accept a bachelor's degree, even when it has been obtained partly on the basis of so-called educational courses, as indicating the equivalent of professional preparation for teaching. At least one year of definite professional preparation in addition to the requirements of the bachelor's degree should be met on the part of secondary school-teachers, as is now required in one State and provided by a few colleges. "These agricultural colleges, though offering ostensibly vocational education, are still tied to the chariot wheels of the B. S. degree, which can in no true sense be a professional degree, and which must always seriously deflect the aims of professional education."

In the chapter on vocational home-making education the author submits a few specific problems, together with methods for their further study and certain tentative proposals for criticism. The characteristics and functions of homes, the vocation of home making, the sociological scope and standards of the home-making functions, the "case method" of study, the project method of teaching home making, the organization and administration of home-economics education, and household arts as liberal education are discussed. The author considers the more effective coordination of home-making education with the home activities of the pupils and the age at which it is efficiently practicable to begin systematic vocational home-making education as the two chief problems of home-making education at the present time.

Introduction to vocational education, D. S. HILL (*New York: Macmillan Co., 1920, pp. XVII+483, figs. 7*).—This is a statement, with an introduction by M. V. O'Shea, of facts and principles related to the vocational aspects of education below college grade. It includes a discussion of the relation of public education to democracy, the meanings, ideals, and adjustments of vocational education to the individual and society, its relation to social problems, the auspices of vocational education, the history of Federal aid, and the development of Federal cooperation. A chapter on problems in agricultural education is devoted to a discussion of the fields of instruction, elementary agriculture, secondary instruction, study and teaching *v.* practice of agriculture, the machinery for adequate agricultural education, applications of the Smith-Hughes law, pedagogical problems, agricultural education in philanthropic and other institutions, the improvement of rural life, problems, and selected references.

The author concludes that both in collegiate and in secondary schools distinctions should be recognized between agricultural courses that are vocational in aim and those agricultural courses that are intended merely to enlarge knowledge and appreciation and to be an adjunct of liberal education. Better coordination is needed between the numerous instrumentalities of training in agriculture at public expense, whether in elementary, secondary, or higher institutions. Pedagogical questions of organization of programs, courses of study, and curricula are pressing, and should be worked out through conference, research, and united efforts of teachers, superintendents, university professors, and State and Federal specialists.

A chapter on the practical education of girls and women considers underlying principles, home economics and household arts education, vocational home-making courses, industrial and trade and extension schools for women, applications of the Smith-Hughes Act, and other vocational education of women. Problems and selected references are included.

The problem of summer teaching in connection with project supervision, A. W. NOLAN (*U. S. Bur. Ed., Sec. School Circ. 7 (1920), pp. 6*).—This paper was presented at the meeting of the American Association for the Advancement of Agricultural Teaching on October 19, 1920, and is based on replies of State supervisors of agricultural education to a questionnaire on the subject.

The author states that 30 of these supervisors reported that they required no systematic book study of vocational students during the summer months, project study outlines and records affording the only written guides in the hands of the pupils for the summer work. In many cases these provided full instructions for carrying on the practical work of the project, for recording all transactions in connection therewith, and for reference readings to be used for a fuller understanding of the project in all its problems and related interests.

The opinions, gathered from 33 replies, may be summed up in the statement that summer teaching should consist largely of personal individual instruction as needed, based upon the seasonal problems of the farm practice; such instruction to pertain to the improvement of skill in the manipulative processes, the solution of problems arising in connection with the project or farm practice, and to principles, basic facts, and related interests necessary for an intelligent understanding for the best practice. In addition to personal conference with a boy at the scene of his work, the author suggests as desirable a project record book for cost accounting and notes relating to the boy's record of the project, and a fully worked-out manual or text, supplied with references at each point, upon the project basis, for each major enterprise likely to be chosen by the vocational students as projects.

Philosophy of agricultural instruction, R. KRZYMOWSKI (*Philosophie der Landwirtschaftslehre. Stuttgart: Eugen Ulmer, 1919, pp. [V]+164, figs. 2*).—The author discusses the fundamental principles of agricultural instruction, including its historical development from the time of Albrecht Thaer, and previous thereto, through that of Justus von Liebig; agriculture as an industry and as a natural phenomenon, and its indispensableness; its position, together with its objects, in the development of intellectual culture; its rationalism and related factors; experimental and nonexperimental inquiry in agriculture; the principle of selection and the historical development of agriculture; supplementing systematic and experimental agricultural instruction by agrarian history and geography; empirical-practical knowledge; and the esthetic element in agriculture and agricultural instruction. A consideration of agrarian geography is appended.

What the agricultural promotion school is and its objects, R. RENTSCHLER (*Württemb. Wchnbl. Landw., 1920, No. 47, pp. 435, 436*).—The proposed organization of agricultural promotion schools (Förderschulen) of intermediate grade, to form the connecting link between the lower agricultural winter and farm schools and the higher agricultural education institutions in Germany, is briefly outlined. As planned, the school would offer a 2-year theoretical course to which would be admitted only students of 19 and 20 years of age who have completed a 2-year course at an agricultural winter school, a farm school, or a viticultural or horticultural school or its equivalent. The advisability of giving special agricultural instruction in these schools is doubted, since this is regarded as the field of the lower and higher agricultural education institutions. Such subjects as economic geography, local geography, the history of civilization, political economy or civics should receive special attention. Agricultural mechanics, geometry, planimetry, and stereometry (surveying and leveling), as well as technical drawing, should be comprehensively taught, and the science subjects should be taught in their relation to agriculture.

Report on the Agricultural Instruction Act, 1919–20 ([*Canada Dept. Agr.*] *Rpt. Agr. Instr. Act, 1919–20, pp. 39*).—This is the annual report for 1919–20 on the allotments and expenditures under the Agricultural Instruction Act and the activities conducted thereunder, including instruction and extension work, colleges and schools of agriculture, veterinary colleges, elementary agricultural education including nature study or rural science and elementary agriculture, junior extension work, school and home gardens, boys' and girls' clubs, and school fairs.

[Agricultural instruction in Ontario, 1919], M. W. DOHERTY (*Ontario Min. Agr. Rpt., 1919, pp. 5–15, 19, 20, 23–66, 73–75, 77, 78*).—This report includes progress reports for 1919 on the activities of the Ontario Agricultural College; the Ontario Veterinary College; farmers' and women's institutes; agricultural representatives, including school fairs and contests, short courses in agriculture, activities of junior farmers, and boys' and girls' club work; the Kemptville Agricultural School; and grants under the Federal Agricultural Instruction Act. It is reported that all degrees for work in the Ontario

Veterinary College will in future be conferred by the University of Toronto, and that the main degree will be B. V. Sc. instead of the degree of V. S. conferred heretofore by the college itself.

First biennial report of the State Board for Vocational Education, M. S. Lewis (*Idaho Bd. Vocat. Ed. Bul., 4 (1921), No. 1, pp. 55, figs. 26*).—This is the report of the department of vocational education of Idaho for the biennium ending December 31, 1920.

By 1920 the number of approved schools had increased to 31, with 904 pupils in agriculture. For the biennium 19 men received training in teaching agriculture at the University of Idaho and 58 by means of itinerant teacher training.

In 1919–20, the number of high schools reimbursed for instruction in vocational home economics was 16, with a total enrollment of 328 students. The enrollment of teachers in the training course in home economics at the University of Idaho increased from 48 in 1918–19 to 60 in 1919–20.

Fourth annual regional conference in home economics—Southern States (*Fed. Bd. Vocat. Ed., Vocat. Summary, 3 (1921), No. 10, pp. 158, 159*).—This report on the proceedings of this conference, held at Montgomery, Ala., January 3–5, 1921, inclusive, presents the recommendations of committees on part-time and evening schools, on standards for teachers of home economics in the South, and on cooperative programs for schools maintaining vocational departments of both agriculture and home economics.

It was recommended that a home economics certificate for teaching in high schools in this region be granted only upon the completion of a college course of 60 college credit hours (120 semester or 180 term hours, exclusive of physical training), and 2 years of vocational experience. Of these credit hours 50 are to be in required subjects. The percentage distribution of time would be as follows: English 10, science (physiology, bacteriology of the home, inorganic and organic chemistry) 20, are (costume designing, house furnishing and decoration) 6.6, education (general and special methods, observation and practice teaching of not less than 30 lessons to a high school class) 15, sociology and economics 5, home economics (garment making, clothing and textiles, millinery, food study and meal preparation, dietetics, home nursing, home management, including supervised work in a practice cottage or apartment for 6 weeks per student, and the care of children) 26.6, and electives 16.8.

It was also recommended that where agriculture is taught some type of home economics should be introduced, which, together with the related subjects, should be arranged to come at the same time as the agricultural subjects.

Organization and results of boys' and girls' club work, Northern and Western States, 1919, G. E. Farrell and I. L. Hobson (*U. S. Dept. Agr., Dept. Circ. 152 (1921), pp. 35, figs. 7*).—The object of boys' and girls' club work is set forth, its organization described, and reports presented of some of the leading results secured in the Northern and Western States in 1919. Various benefits of club work to the members and to the community are emphasized.

MISCELLANEOUS.

Thirty-third Annual Report of Indiana Station, 1920 (*Indiana Sta. Rpt. 1920, pp. 59, figs. 5*).—This contains the organization list, a report of the director summarizing the activities of the station, publications of the year, changes in staff, etc., and a financial statement for the Federal funds for the fiscal year ended June 30, 1920, and for the remaining funds for the fiscal year ended September 30, 1920. The experimental work reported is for the most part abstracted elsewhere in this issue.

Thirty-third Annual Report of Maryland Station, 1920 (*Maryland Sta. Rpt. 1920, pp. IX+140, figs. 61*).—This contains the organization list; a report by the director on the work and publications of the station; a financial statement for the fiscal year ended June 30, 1920, and reprints of Bulletins 228–236, previously noted.

Report from Holly Springs Branch Experiment Station for 1915 to 1920, inclusive, C. T. Ames (*Mississippi Sta. Bul. 193 (1920), pp. 22, figs. 2*).—The experimental work covered in this report is for the most part abstracted elsewhere in this issue.

Thirty-eighth Annual Report of New York State Station, 1919 (*New York State Sta. Rpt. 1919 [pt. 1], pp. VII+554, pls. 44, figs. 37*).—Part 1 of this report contains the organization list; a financial statement for the fiscal year ended June 30, 1919; a list of the periodicals received by the station; meteorological observations abstracted on page 113 of this issue; and reprints of Bulletins 458–461, 463–466, 468, and 470; Technical Bulletins 66–74; and popular editions of Bulletins 459, 463, 466, and 468, all of which have been previously noted.

Thirty-ninth Annual Report of Ohio Station, 1920 (*Ohio Sta. Bul. 346 (1920), pp. XL+[6], fig. 1*).—This contains the organization list, a financial statement for the fiscal year ended June 30, 1920, and a report of the director summarizing the work and publications of the station during the year, with a brief summary of the work of the station during its entire history. The current experimental work reported is for the most part abstracted elsewhere in this issue.

County experiment farms in Ohio, annual reports for 1918 and 1919 (*Ohio Sta. Bul. 344 (1920), pp. 223–478, figs. 25*).—This contains reports for the nine county experiment farms in Ohio, including financial summaries, crop and labor statistics, farm work reports, data on the maintenance of soil fertility, variety comparison, etc. The experimental work reported is for the most part abstracted elsewhere in this issue.

Report of the Virgin Islands Station, 1920 (*Virgin Islands Sta. Rpt. 1920, pp. 35, pls. 4*).—This includes the organization list, and a report by the agronomist in charge as to the work of the station for the fiscal year ended June 30, 1920. A report of the entomologist is included, and rainfall data are appended. The experimental work reported is for the most part abstracted elsewhere in this issue.

Monthly bulletin of the Western Washington Substation (*Washington Sta., West. Wash. Sta. Mo. Bul., 9 (1921), No. 1, pp. 16*).—This number contains brief articles on the following subjects: The State Division of Agriculture, by A. L. Melander; Finding a Location and Beginning with Bees, by G. W. York; Resetting Old Berry Plants, and Tomato Culture in Western Washington, both by J. L. Stahl; Adapted Pasture and Hay Grasses, and Varieties of Spring-sown Crops, both by M. E. McCollam; Common Chick Diseases, by W. T. Johnson (see p. 183); and Care of Rabbits, by F. W. Arms.

An agricultural almanac for 1921, compiled by B. Adams (*U. S. Dept. Agr., Farmers' Bul. 1202 (1921), pp. 64, figs. 2*).—This publication, compiled from sources within the Department for the use of farmers, gardeners, householders, and others, contains the usual sunrise and sunset data, gestation tables, notes on agricultural operations suited to the various months, a chronology of important agricultural events, and miscellaneous farm helps as to fertilizers, sprays, weights of commodities, etc.

NOTES.

Arizona Station.—Leslie Beaty, county agent of Otero County, N. Mex., has been appointed manager of the station date orchard at Yuma.

Florida University and Station.—J. C. Cooper, jr., of Jacksonville, and W. S. Weaver, of Perry, have been appointed to the board of control, vice J. B. Hodges and H. B. Minium, whose terms expire July 1. P. K. Yonge has been appointed chairman of the board.

J. B. Thompson, specialist in forage crops, resigned August 9 to become agronomist in charge of the Virgin Islands Station. J. M. Coleman has been appointed assistant chemist, beginning July 15, in connection with the soft pork investigations of the station.

Georgia Station.—W. A. Morgan, a recent graduate of the Georgia School of Technology, has been appointed assistant chemist, beginning July 15.

Purdue University and Station.—The tragic death is noted of President W. E. Stone on July 16 while ascending Mount Eanon in the Canadian Rockies.

President Stone was born in Chesterfield, N. H., June 12, 1862. He was graduated from the Massachusetts Agricultural College in 1882 and served as assistant chemist in the Massachusetts Station from 1884 to 1886. In 1888 he received the degree of Doctor of Philosophy from the University of Goettingen, and on returning to this country became chemist at the Tennessee Station. In 1889 he was appointed professor of chemistry in Purdue University and in 1892 vice president, continuing in this capacity until his election as president in 1900.

During his long administration the university underwent remarkable development, especially along agricultural lines, and he became widely known as one of the leading executives in the land grant college group of institutions. He was for years one of the dominant figures in the Association of American Agricultural Colleges and Experiment Stations, serving repeatedly as a member of the executive committee and as its president in 1911–12, and was the author of the plan under which the association became the Association of Land Grant Colleges in 1919.

C. W. Carrick, who has been engaged in poultry extension work in the State, has been appointed associate in poultry husbandry in the station. E. H. Parfitt has been appointed dairy bacteriologist; C. R. Cleveland, assistant entomologist; and Leroy G. Gordner, assistant in short courses and exhibits.

Maine University.—Dr. R. J. Aley has resigned as president to become the head of Butler College, Indianapolis, beginning September 1.

Maryland University.—*Breeder's Gazette* notes that B. E. Carmichael, formerly of the Ohio Station, has been appointed extension specialist in animal husbandry, beginning July 5.

Massachusetts College and Station.—President K. L. Butterfield has been granted leave of absence until February 1, 1922, in order to serve with the Chinese Educational Commission in making a special study of agricultural education in China and Japan. Dean E. M. Lewis has been designated as acting president.

Cooperative investigational work has been started by the station on the control of apple scab in and around Littleton. Arthur P. French has been appointed investigator in pomology, beginning July 11. Miss Marguerite G. Ickis, curator in the department of botany, resigned July 31.

Cornell University.—Dr. Livingston Farrand, chairman of the central committee of the American Red Cross and formerly adjunct professor of psychology and professor of anthropology in Columbia University and president of the University of Colorado, has been appointed president of the university, vice Dr. J. G.

Schumann, who resigned about a year ago after 28 years' service, and whose appointment as minister to China was recently confirmed by the U. S. Senate.

By a reorganization effective July 1, the department of farm crops has been discontinued, the division of vegetable gardening has become the department of vegetable gardening, and the department of soil technology is now the department of agronomy. Of the members of the farm crops staff, E. V. Hardenburg is now assistant professor of vegetable gardening, and J. H. Barron and H. P. Cooper have been transferred to the department of agronomy as extension professor and instructor, respectively, of field crops. R. G. Wiggans has been transferred to the plant breeding department. The new agronomy department will deal with all phases of crop production, and the plant breeding department with plant improvement work.

Dr. George F. Warren, head of the department of agricultural economics and farm management, has been granted leave of absence until February 1, 1922, to serve as consulting specialist to the Chief of the Bureau of Markets and Crop Estimates of the U. S. Department of Agriculture. Bristow Adams, chief of the office of publications, has been granted sabbatical leave to be spent in advance study for the second term of 1921–22.

Ohio State University and Station.—Dr. C. L. Metcalf, professor of zoology and entomology in the university, has resigned to become professor of entomology and head of the department in the Illinois University and Station.

In the station the appointments are noted of Edmund Secrest as associate director, and of J. H. Gourley, professor of horticulture and horticulturist of the West Virginia University and Station, as chief of the horticultural department. D. C. Kennard, assistant in poultry studies in the Indianapolis food research laboratory of the Bureau of Chemistry, U. S. Department of Agriculture, has been appointed associate in the department of animal industry in charge of poultry work, vice W. J. Buss, who resigned to engage in commercial work. P. S. White of the same laboratory has been appointed assistant in the poultry division.

West Virginia University and Station.—Appointments, effective July 1, include the following: Eugene P. Deatrick, Ph. D., as associate professor of soils and in charge of the soils department of the station, vice R. M. Salter, resigned; J. H. Longwell as assistant professor in animal husbandry and assistant animal husbandman; Ferris D. Cornell, instructor in farm engineering and in charge of station farm engineering work; Goldan O. Hall, istructor in poultry and assistant in poultry husbandry; and K. S. Quisenberry, instructor in agronomy and assistant in agronomy in the station.

Wyoming University and Station.—The university has awarded the contract for a new heating plant, and construction work has been begun. F. W. Geddes, Dean Prosser, and J. A. Elliott have been appointed members of the board of trustees to succeed C. D. Spalding, J. M. Carey, and C. P. Arnold. Dr. E. H. Lehnert, head of the veterinary department, and H. P. Kjerschow-Agersborg, assistant professor of zoology and assistant parasitologist, have resigned.

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EXPERIMENT STATION RECORD.

VOL. 45. ABSTRACT NUMBER. No. 3.

RECENT WORK IN AGRICULTURE SCIENCE.

AGRICULTURAL CHEMISTRY—AGROTECHNY.

The physico-chemical foundations of biology with an introduction to the basic principles of higher mathematics, E. EICHWALD and A. FODOR (*Die Physikalisch-Chemischen Grundlagen der Biologie mit einer Einführung in die Grundbegriffe der Höheren Mathematik. Berlin: Julius Springer, 1919, pp. X+510, pls. 2, figs. 119*).—This treatise consists of introductory sections on biological methods and on the basic principles of higher mathematics (integral and differential calculus), followed by sections dealing with the state of matter, atomic and structural theory, the kinetics of chemical reactions, and the doctrine of energy.

Applied chemistry.—I, Water, detergents, textiles, fuels, etc., C. K. TINKLER and H. MASTERS (*London: Crosby Lockwood & Son, 1920, vol. 1, pp. XII+292, pls. 2, figs. 34; rev. in Analyst, 45 (1920), No. 534, pp. 346, 347*).—This handbook has been written as a guide to the practical work in applied chemistry which is given in the last year of the three years' course in household and social science at King's College for Women, London. The laboratory work outlined deals with water analysis, water softeners and soda substitutes, soap, textile fibers, bleaching agents, dry cleaning, air analysis, gaseous fuels, liquid and solid fuels, and materials used for the protection of wood, metal, and other surfaces. A second volume dealing with foods is in preparation.

Organic chemistry for advanced students.—I, Reactions. II, Structure. III, Synthesis, J. B. COHEN (*London: Edward Arnold; New York: Longmans, Green & Co., 1920, 3. ed., pts. 1, pp. VIII+366, figs. 4; 2, pp. VII+435, pls. 2, figs. 60; 3, pp. VII+378*).—This is a reprint of the second edition (E. S. R., 40, p. 709) with the addition of a number of references to recent literature.

Catalysis and its industrial applications, E. JOBLING (*London: J. & A. Churchill, 1920, 2. ed., pp. VIII+144, figs. 12*).—This book deals briefly with the rôle of catalysis in various processes of chemical industry. Literature references are given at the end of each chapter.

An introduction to the chemistry of plant products.—I, On the nature and significance of the commoner organic compounds of plants, P. HAAS and T. G. HILL (*London: Longmans, Green, and Co., 1921, 3. ed., pp. XIII+414, figs. 3*).—The third edition of this work is to appear in two volumes of which this is the first. The present volume is essentially the same in scope as the previous edition (E. S. R., 37, p. 801), dealing primarily with the more chemical phases of the subject, while the second, which is in preparation, is to be devoted to the more purely physiological problems.

The chemical constitution and synthesis of the principal phospho-organic reserve material of green plants, S. Posternak (*Soc. Phys. et Hist. Nat. Genève, Compt. Rend., 37 (1920), No. 3, pp. 70–74*).—The author reiterates his former statement in regard to the synthesis of a phytic acid identical with the natural phytic acid of plant materials, and claims that the inability of Anderson to confirm his work (E. S. R., 44, p. 410) was due to faulty methods of separating the synthesized acid from the reaction mixture.

The preparation and analysis of a cattle food consisting of hydrolyzed sawdust, E. C. Sherrard and G. W. Blanco (*Jour. Indus. and Engin. Chem., 13 (1921), No. 1, pp. 61–65, fig. 1*).—This contribution from the U. S. Forest Products Laboratory, Madison, Wis., describes the process of manufacture of a hydrolyzed cellulose which has been fed to three dairy cows with good results, as noted on page 275.

Eastern white pine sawdust was digested with 1.8 per cent H_2SO_4 for 15 or 20 minutes under a pressure of 120 lbs. per square inch, sufficient water being added to raise the ratio of water to dry wood to about 1.25:1. The digested sawdust was then centrifuged to remove the greater part of the acid liquor, the centrifuged material placed in towers, and the remainder of the sugar and acid extracted with hot water. Five complete washings with a quantity of water equivalent to the weight of wood were sufficient to remove practically all of the H_2SO_4. The leached water was mixed with the centrifuged liquor and almost neutralized with $CaCO_3$, and finally decanted or filtered and evaporated under reduced pressure to a thick sirup. The leached material from the towers was screened through a 6-mesh screen and the screenings air dried, mixed with the sirup, and the whole dried to a moisture content of about 12 per cent. To avoid loss of sugar it was found advisable to conduct the drying in an oven at a temperature of from 75 to 85° C.

Analyses by the Schorger method (E. S. R., 37, p. 502) of the unhydrolyzed sawdust and the hydrolyzed stock food are reported, separate analyses for both being made of material passing 100-mesh screens without grinding and the residue ground to pass through a 100-mesh screen. The principal difference between the fine and coarse material in both cases was in the percentage of ash, which was higher in the fine samples. The hot and cold water and alkali soluble materials were greatly increased by hydrolysis, while the ether soluble materials remained about the same. About 45.4 per cent of the original pentosans remained in the finished product. The loss of cellulose brought about by the hydrolysis was 21.68 per cent from which 15.5 per cent of total reducing sugars was produced, showing a yield of sugar approximately 71.5 per cent of the theoretical. The final cellulose differed from that of the original wood in its behavior toward alkali, practically all of the cellulose being converted into a viscous semitransparent mass by 17.5 per cent NaOH, while in the original cellulose over 50 per cent was unaffected. The altered cellulose is thought to be a product intermediate between α-and β-cellulose, and one which is more easily digested in the alkaline intestinal tract than pure α-cellulose. The total quantity of lignin was not appreciably altered. Crude fiber was reduced from an original content of 63.87 and 60.81 to 46.88 and 49.31 per cent.

The apple storage problem (*Idaho Sta. Bul. 122 (1921), p. 21*).—In this progress report on the problem of apple storage, it is stated that "the chemical change taking place in an apple during the period of growth, ripening, and storage can now be followed by means of physical measurements on the expressed juice.

"In the early stages of growth of the apple, hexose sugars predominate. Later in the growth the sugars are followed by a formation of starch as a reserve material. During ripening sucrose is also formed. In the later stages, in the so-called after-ripening period, sucrose is changed to invert sugars. These changes have been followed by the freezing point method. After-ripening is characterized by increased osmotic pressure, lowering of the surface tension and a marked increase in viscosity of the juice."

The separation of serum proteins, M. Piettre and A. Villa (*Compt. Rend. Acad. Sci.* [*Paris*], *170* (*1920*), *No. 24, pp. 1466–1468*).—A method of separating the constituents of blood serum is described, which consists briefly in neutralizing the serum with normal HCl, using litmus paper as indicator, precipitating the neutralized serum with 2.5 volumes of acetone, filtering, washing the precipitate with ether, digesting it for several hours with distilled water (70 cc. of water to 100 of serum), saturating with CO_2, and centrifuging. The final precipitate contains the insoluble proteins with the exception of albumin; the wash water, the albumin; and the liquid after the original precipitation the fats, lipoids, mineral matter, and all the soluble organic products.

The quantitative determination of tyrosin by means of Millon's reaction, M. Weiss (*Biochem. Ztschr., 97 1919*), *No. 3–5, pp. 170–175*).—The method described depends upon the dilution of the solution to be tested until the color developed with Millon's reagent is the same as that of a standard solution containing a definite amount of tyrosin.

Nucleic acids.—Their chemical properties and physiological conduct, W. Jones (*London and New York: Longmans, Green & Co., 1920, 2. ed.* [*rev. and enl.*], *pp. VIII+150, figs. 3*).—The previously noted monograph (E. S. R., 32, p. 201), of the series edited by R. H. A. Plimmer and F. G. Hopkins, has been revised and enlarged to include the developments in the chemistry of the nucleic acids which have occurred in the intervening six years. Important among these are the definite preparation of the four nucleosids of plant nucleic acid which were in the hypothetical stage at the time of writing of the first edition, and the study of the evolutionary relations of animal species with respect to purin metabolism. Attention is called to the fact that in regard to the most striking feature of purin metabolism, the ability to convert uric acid into allantoin, the lower animals, including the monkey, resemble one another in having a high uricolytic index, while in the ape and man the uricolytic index is zero, the gap thus occurring between the monkey and ape rather than between the ape and man.

Animal fats and oils, L. E. Andés, trans. by H. B. Stocks (*London: Scott, Greenwood & Son, 1920, 3. ed., rev. and enl., pp. VIII+315, figs. 76*).—This is the third English edition by H. B. Stocks of this reference book on the practical production, properties, falsification, and examination of animal fats and oils. The companion volume on vegetable fats and oils has been previously noted (E. S. R., 41, p. 110).

[Progress in fat chemistry in 1919], W. Fahrion (*Chem. Umschau Geb. Fette, Oele, Wachse, u. Harze, 27* (*1920*), *Nos. 21, pp. 214–216; 22, pp. 225–228; 23, pp. 238–242*).—This continues for 1919 the literature review of theoretical (pp. 214–216), analytical (pp. 225–228), and technical (pp. 238–242) fat chemistry (E. S. R., 43, p. 201).

The chemistry of the polysaccharids, E. Herzfeld and R. Klinger (*Biochem. Ztschr., 107* (*1920*), *No. 4–6, pp. 268–294, figs. 6; abs. in Chem. Abs., 15* (*1921*), *No. 1, p. 99*).—To obtain polysaccharids in a pure form, the authors employ a method which consists briefly in the splitting up of all impurities into alcohol-soluble components by the action of alkali in the warm, precipitation of the intact polysaccharids with 90 per cent alcohol, resolution in water, and reprecipitation with alcohol. Potato and rice starch, yeast polysaccharids, cellulose, agar, glycogen, and inulin have been thus purified, and were found to be practically ash-and nitrogen free. The behavior of the purified products toward various reagents is described and discussed from the standpoint of colloidal chemistry.

The iodin reaction is considered to depend upon the adsorption of the iodin on the surface of the colloidal particles, the differences in color being due to the degree of dispersion from the less highly dispersed starch, giving a blue color, to the highly dispersed dextrin, giving a reddish brown color. Dextrins are considered to be more highly dispersed starches rather than split products or, expressed in other terms, the action of diastatic enzyms is not one of hydrolysis but one of dispersion. The various plant polysaccharids are considered to differ from one another only in the amount of dextrin particles and in the presence or absence of foreign materials such as lignin, etc. Glycogen is considered as a more dispersed form of starch resulting from the action of solvents in the body.

The chemistry of the polysaccharids, M. SAMEC (*Biochem. Ztschr., 113 (1921), No. 1–6, pp. 255, 256*).—Exception is taken to the conclusions drawn by Herzfeld and Klinger in the paper noted above, especially on the ground that the action of the 33 per cent NaOH used in purifying the starch results in a disintegration of the starch molecule so that the resulting solution is no longer pure starch.

A compound of starch with phosphoric acid, J. KERB (*Biochem. Ztschr., 100 (1919), pp. 3–14*).—On treating a solution of soluble starch with calcium carbonate followed by phosphorus oxychlorid in chloroform, concentrating the solution, and adding alcohol, a calcium salt of a starch phosphoric acid was precipitated. This did not hydrolyze readily with HCl, but on treatment with taka-diastase yielded a hexose monophosphoric acid fermentable by yeast.

Cellulose and its esters: Their industrial application, L. CLÉMENT and C. RIVIÈRE (*La Cellulose et les Éthers Cellulosiques leurs Applications Industrielles. Paris: Libr. Polytech., 1920, pp. [1]+III+356, figs. 66*).—This volume deals with the chemistry and technology of the various esters of cellulose, particularly cellulose acetates.

The occurrence of saponin in dried extracted cossettes, A. TRAEGEL (*Ztschr. Ver. Deut. Zuckerindus., 1920, No. 777, II, pp. 449–459; abs. in Chem. Abs., 15 (1921), No. 2, p. 323*).—Evidence is presented that saponins occur in appreciable amounts in extracted beet pulp as well as in the diffusion juice. The proportion of saponin in the juice and in the remaining cossettes has not been determined.

A review of recent work on enzym action, R. J. S. McDOWALL (*Sci. Prog. [London], 15 (1921), No. 59, pp. 406–434*).—This review and discussion of recent literature on enzym action covers the period of 1910–1919.

Contribution to the chemical nature of enzyms, T. BOKORNY (*Biochem. Ztschr. 100 (1919), pp. 100–113, fig. 1*).—A comparison of the alkyl amid nitrogen and total nitrogen content of various commercial enzyms with corresponding figures for certain proteins is reported, the results of which are thought to indicate that these enzyms are of the nature of proteins. The percentage of alkyl amid nitrogen or nitrogen evolved by HNO_2 was as follows: Pepsin 3.16, emulsin 4.417, diastase 4.9, rennet 3.05, taka-diastase 3.5, papayotin 7.66, egg albumin 3.281, casein 5.93, somatose 6.47, and Witte's peptone 12.4. Total nitrogen determinations include pepsin 14.44, diastase 15.3, egg albumin 16.6, casein 15.7, and konglutin from almonds 18.4 per cent.

Pectase action, H. EULER and O. SVANBERG (*Biochem. Ztschr., 100 (1919), pp. 271–278*).—The juices of black and red currants and gooseberries (*Ribes *nigrum*, *R. rubrum*, and *R. grossularia*), were found to have H-ion concentrations of pH=2.96, 2.8, and 2.91 to 2.87, respectively. By partially neutralizing these juices with NaOH the optimum acidity for pectase action was found to be at pH=4.3. The action of pectase was found to be nonspecific for the three varieties tested.

The determination of H-ion concentration by means of indicators, L. MICHAELIS and A. GYEMANT (*Biochem. Ztschr., 109 (1920), pp. 165–210 figs. 9*).—The method described differs from other indicator methods of determining H-ion concentration in that no buffer solutions are required and that the determinations can be made at any temperature up to 37° C. The principle involved is that if a single-colored indicator such as phenolphthalein or nitrophenol, but not litmus or methyl orange, is added to a solution the depth of color will be somewhere between the absence of color of the acid and the extreme depth of color of the base, and that consequently at definite H-ion concentrations definite depths of color will be produced. The technique is essentially as follows:

To 5 or 10 cc. of the solution to be tested is added from a pipette sufficient indicator to produce quite a deep color. In a similar beaker is placed 4 or 9 cc. of N/100 NaOH and the indicator added until the same depth of color is obtained, after which, if necessary, more alkali is added to make the volume the same as that of the unknown solution. The H-ion concentration is then calculated from the equation $pH=pK+\phi$, where K is the dissociation constant of the indicator at the given temperature and ϕ is a function of the difference in the amount of indicator used in the unknown and standard solution (F) expressed by $\frac{\log F.}{1—F}$

Indicators practical for the method include saturated solutions of α and β dinitrophenol, 0.1 per cent solution of *p*-nitrophenol, and 0.3 per cent solution of *m*-nitrophenol. Tables are given of the dissociation constants of these and other indicators at different temperatures, the function ϕ corresponding to various values of F, and other data of value in the determination.

Determination of the reaction of culture media by measurement of the H-ion concentration, A. PONSELLE (*Bul. Inst. Pasteur, 18 (1920), No. 18, pp. 601–610, fig. 1*).—This is a brief discussion of the application of the colorimetric method of determining H-ion concentration to the adjustment of culture media. A list of 17 literature references is appended.

The determination of the reaction of bacteriological culture media, J. MCINTOSH and W. A. M. SMART (*Brit. Jour. Expt. Path., 1 (1920), No. 1, pp. 9–30, figs. 5*).—As the result of an examination of various methods of adjusting the reaction of bacteriological media, the authors recommend for ordinary routine purposes the titration of a small volume with thymolphthalein as an indicator to the so-called neutral point corresponding to the first perceptible darkening observed on the addition of alkali, the titration being carried out in the cold. From the results obtained, the alkali required to be added to the remainder of the medium can be calculated and added, and the final reaction adjusted by the addition of *n* HCl to a reaction corresponding to that of plasma or pH=7.6.

Data are presented showing that in a given medium of known original reaction there is a constant relation between the pH and the amount of acid added. Graphs illustrating this for ordinary and double strength broth are presented by means of which the H-ion concentration of the broth can be calculated from the amount of acid added. For controlling the final reaction two 3 cc. samples of the medium are diluted in test tubes with an equal bulk of distilled water. To one tube is added 2 drops of 0.5 per cent alcoholic solution of phenolphthalein and to the other 2 drops of 0.02 per cent aqueous solution of cresol red. If the reaction is correct no color change should occur in the first and a rose or pinkish color in the second tube. A pink color in the first tube indicates that the medium is too alkaline and a brown color in the second tube too acid. The error in either direction is adjusted by the addition of a few drops of N NaOH or HCl to the medium in bulk and the control test repeated.

The determination of nitrate nitrogen with copper-magnesium alloy, T. Arnd (*Ztschr. Angew. Chem.*, *33* (*1920*), *No. 96*, *Aufsatz.*, *pp. 296–298; abs. in Chem. Abs.*, *15* (*1921*), *No. 4*, *p. 487*).—In answer to questions that had arisen concerning the application of the method of determining nitrate nitrogen previously described (E. S. R., 42, p. 205), the author reports the results of practical tests of the method under varying conditions. Chlorids and difficultly soluble sulphates, even when present in considerable amounts, were found to have no influence on the determination. Soluble sulphates were found to affect the results unfavorably, but this was easily corrected by the addition of more magnesium chlorid. The use of 50 cc. instead of 5 cc. of the magnesium chlorid for 0.5 gm. of nitrogen is, therefore, recommended with an increase in the copper-magnesium alloy to at least 5 gm. The fineness of division of the alloy was found to have no effect on the results.

The determination of cyanamid nitrogen in calcium cyanamid, H. Neubauer (*Ztschr. Angew Chem.*, *33* (*1920*), *Nos. 82*, *Aufsatz.*, *pp. 247*, *248; 84*, *Aufsatz.*, *pp. 254–256; abs. in Chem. Abs.*, *15* (*1921*), *No. 4*, *pp. 487*, *488*).—For estimating the available nitrogen in commercial fertilizers containing calcium cyanamid, the author recommends the following method:

One gm. of the finely divided material is extracted with 100 cc. of acetone in successive 20 cc. portions to remove dicyanamid, urea, and free cyanamid. The residue is then treated in a flask provided with a reflux condenser with 3 gm. of Arnd's magnesium-copper alloy, 5 cc. of 20 per cent $MgCl_2$ solution, and 15 cc. of glacial acetic acid. After 10 minutes the condenser and flask are washed down with distilled water, an additional 3 gm. of the alloy is added, and the reaction allowed to proceed for 10 minutes longer, after which the condenser is again washed down, the solution diluted to 300 cc., an excess of sodium hydroxid added, and the ammonia distilled into standard acid.

To recover the acetone it is shaken with oxalic acid to neutralize the ammonia present, distilled at a temperature not exceeding 58° C., dried over potassium carbonate, and again distilled. The nitrogen in the acetone extract may be determined by the Kjeldahl method in the residue after the acetone distillation. Nitrogen which has been retained by free carbon in the original sample may be determined in the residue from the original ammonia distillation.

Iodic acid as a microchemical reagent for soluble and insoluble compounds of calcium, strontium, and barium, G. Denigès (*Compt. Rend. Acad. Sci.* [*Paris*], *170* (*1920*), *No. 17*, *pp. 996–998*).—The author suggests the use of a 10 per cent solution of iodic acid as a means of distinguishing between calcium, strontium, and barium in minute amounts of their salts.

A grain of the salt to be tested is pulverized and mixed on a glass plate with a drop of water. To this is added a drop of the iodic acid solution. Examined under the microscope characteristic crystals are noted, pointed octahedra for calcium compounds, shorter octahedra with rhombic prisms for strontium, and sharp needle-like prisms grouped in sheaths for barium.

Determination of fats in cereal products, raw or cooked, and its application in determining flour grades, B. R. Jacobs and O. S. Rask (*Oper. Miller*, *26* (*1921*), *No. 2*, *p. 35*).—In the method described 5 gm. of the sample is digested in a 200 cc. Erlenmeyer flask for 2 minutes on the steam bath with a mixture of 10 cc. of 95 per cent alcohol, 2 cc. concentrated ammonia, and 3 cc. of water. After cooling, the contents of the flask are digested with three successive portions of ethyl ether, after which the entire process is repeated. The combined ether extracts are evaporated to dryness on a steam bath, the fat is extracted from the residue with a mixture of equal parts of ether and low boiling petroleum ether, and the extracts are collected in a tared beaker, evaporated to dryness on a steam bath, dried at 100° C. for an hour, cooled in a desiccator, and weighed.

Data on the percentage of fat recovered by this and the direct ether extraction methods indicate a greater recovery with the former method.

The detection of methyl anthranilate in fruit juices, F. B. Power (*Jour. Amer. Chem. Soc., 43 (1921), No. 2, pp. 377–381*).—The author at the Bureau of Chemistry, U. S. Department of Agriculture, has devised a method for detecting methyl anthranilate in grape juice and other fruit juices. The essential features of the process consist in the distillation of the fruit juice with steam, using 500 cc. of the liquid and collecting about 200 cc. of the distillate, and the extraction of the distillate with three successive portions of 10 cc. each of chloroform, after which the extract is evaporated on a water bath, the residue treated with 2 cc. of 10 per cent sulphuric acid, and the solution transferred to a test tube. The liquid is then diazotized and tested with a solution of β-naphthol, prepared by dissolving 0.5 gm. of pure β-naphthol in 2 cc. of a 10 per cent solution of NaOH and diluting the liquid to 100 cc. On adding 1 cc. of this solution, 1 cc. of a 10 per cent solution of NaOH, and 1 cc. of a 10 per cent solution of monohydrated sodium carbonate to 2 cc. of the diazotized liquid a yellowish-red precipitate is produced if not less than 0.001 gm. of methyl anthranilate is present.

Milk and hemolysis, H. Violle (*Compt. Rend. Acad. Sci. [Paris], 170 (1920), No. 18, pp. 1078, 1079*).—The author states that normal milk, undiluted or diluted by the addition of distilled water to about three-tenths of its volume, does not hemolyze red blood cells, while milk altered by the addition or subtraction of any of its normal components or by the action of foreign substances rapidly hemolyzes red cells. The test is suggested as a rapid means of detecting abnormality in milk samples, although it does not indicate the nature of the abnormality.

Sour milk samples and Gerber's fat method, F. E. Day (*Analyst, 45 (1920), No. 536, pp. 411, 412*).—The author notes that the use of the Gerber method for determining the fat content of milk is apt to give very misleading results with sour milk owing to the formation of amyl esters of the lower aliphatic acids. Determinations on milk to which small amounts of acetic, butyric, and lactic acids had been added and on spontaneously soured milk of various ages are reported. Lactic acid had apparently no effect, acetic a slight, and butyric a decided effect upon the fat determination, the results in the last two cases being higher than those of the controls.

The chemistry and analysis of drugs and medicines, H. C. Fuller (*New York: John Wiley & Sons, Inc., 1920, pp. IX+1072, figs. 19*).—The subject matter in this reference book on drugs and medicines and analytical procedures for their identification and quantitative determination is presented in the following general sections: General methods and crude drug assays; alkaloidal drugs, alkaloids, and medicinally allied substances; glucosids, glucosidal drugs, and natural drugs containing principles other than alkaloids; organic substances other than alkaloids and glucosids; and an inorganic section.

In each section " those characteristics of the different substances valuable for their analytical significance have been detailed, many new, important, and hitherto obscure reactions have been recorded, and wherever reliable quantitative methods of determination and separation could be found, they have been described. In the treatment of the individual drugs and medicinal agents considerable space has been devoted to detailing the character of the remedies in which they commonly occur, and the combinations usually found in practice."

In assembling the material the literature during the past 20 years has been reviewed and where utilized has been noted by literature references. Tables useful in the analytical procedures are assembled at the end of the volume.

A cryoscopic method for the estimation of sucrose, H. H. Dixon and T. G. Mason (*Roy. Dublin Soc. Sci. Proc., n. ser., 16 (1920), No. 1, pp. 8*).—The authors suggest a cryoscopic method for the estimation of sucrose in small amounts of fluids, and describe the technique of such a method as applied to plant sap.

The plant material is frozen to render the tissues permeable, and the sap is extracted by pressure between two silver disks and collected in test tubes surrounded by ice. Fifteen cc. of the sample is then boiled in a test tube under a reflux condenser for one minute to destroy the enzyms, filtered into two test tubes (5 gm. into each), and immersed in a freezing liquid at —2° C., and 0.33 gm. of invertase solution added to each tube. The freezing point of the liquid is determined, after which the tubes are allowed to stand over night at 28° and the freezing point is again determined. From the difference in the observed depressions before and after inversion, the concentration of sucrose is determined on the assumption that the freezing point depression of sucrose is exactly doubled on inversion.

The method, which is said to have a possible error of 0.0016 gm., is recommended particularly for work in relation to the osmotic pressure in plants, and for sucrose determinations in any plant material in which preliminary treatment for the purpose of clearing the sap of gums, etc., would be required in the polarimetric or copper methods.

Studies on blood sugar—effect of blood constituents on picrate solutions.—A consideration of the limitations of the modified Lewis-Benedict test, D. M. Cowie and J. P. Parsons (*Arch. Int. Med., 26 (1920), No. 3, pp. 333–342*).—The criticisms of Maclean (E. S. R., 41, p. 505) and De Wesselow (E. S. R., 41, p. 506) of the reliability of the Lewis-Benedict picric acid method for determining blood sugar led to an examination of the effect of various substances on this determination, the results of which may be summarized as follows:

Oxalation produced no difference in the reaction of normal and diabetic blood. Uric acid, ammonia nitrogen, and several amino acids were also without effect. Creatinin, acetone, adrenalin, and diacetic acid reacted to picrate solutions, the limit of picrate sensitiveness in blood to creatinin being 4, acetic acid 50, acetone 500, and adrenalin 1,000 times greater than to glucose.

In discussing these results it is pointed out that while under normal conditions these substances may not interfere with the established normal range for this method, under pathological conditions several may exert a marked influence. The question is raised as to whether the acetone bodies of the blood do not contribute to the established normal blood sugar range for the Lewis-Benedict test, and whether adrenalin may not induce a so-called hyperglycemia without mobilizing the glycogen stores of the liver.

Manufacture of sugar cane sirup on small scale (*Fla. Dept. Agr. Bien. Rpt., 16 (1919–20), pt. 1, pp. 214–217*).—This contribution from the Bureau of Chemistry, U. S. Department of Agriculture, consists of brief directions for making small quantities of sugar-cane sirup. The methods are essentially the same as those used for the manufacture of sorghum sirup on a small scale as discussed in Farmers' Bulletin 477 (E. S. R., 26, p. 512). The chief difference in making the sirup from sugar cane and from sorghum lies in the fact that in sorghum cane there is considerable starch which is expressed with the juice and should be allowed to settle before the juice is run to the evaporator, while the sugar-cane juice does not require settling.

The utilization of waste molasses in the Philippine Islands, with special reference to the haciendas of Negros, H. J. Carsten (*Philippine Jour. Sci., 17 (1920), No. 4, pp. 395–407*).—A brief description of methods for the disposal of waste molasses.

The dry distillation of extracted cossettes, W. Paar and A. Starke (*Ztschr. Ver. Deut. Zuckerindus., 1920, No. 777, II, pp. 445–449; abs. in Chem. Abs., 15 (1921), No. 2, p. 323*).—In an effort to determine the cause of explosions sometimes occurring in cossette drying plants, the authors subjected samples of the cossettes to destructive distillation at from 500 to 600° C. and obtained gases forming an explosive mixture with air. The necessity of a careful control of drying process to prevent overheating is emphasized.

Gur making from the juice of the date palm (Phoenis sylvestris) in the Thana district of the Bombay Presidency, V. G. Patwardhan (*La. Planter, 66 (1921), No. 12, pp. 190, 191*).—Experiments conducted at Sanjan and Tadgaum in the Thana district of Bombay on improvements in the methods of making gur or sugar from date palm juice are briefly reported.

The juice used for gur making was always the night collection as the day collection rapidly fermented. The best results were obtained by using formalin to prevent fermentation of the juice during its collection, and by adding to the juice before boiling one-fourth of the amount of citric acid required to neutralize the alkalinity of the original juice.

Vinegar studies, W. G. Sackett (*Colorado Sta. Rpt. 1920, pp. 22, 23*).—Attempts to make good vinegar from molasses, sugar, and water with the use of "vinegar bees" gave variable results, while with pure yeast cultures very satisfactory molasses vinegar could be prepared in from 6 to 8 weeks. A test of the possibility of utilizing waste cantaloups from the seed-producing sections of the State for vinegar showed that fresh cantaloup juice does not contain sufficient fermentable sugar to produce the alcohol necessary to make marketable vinegar. The possibility is suggested of concentrating the juice to a point at which the sugar content would satisfy the requirements of a vinegar stock.

Report of vinegar investigations, Z. Northrup [Wyant] (*Michigan Sta. Rpt. 1919, pp. 243–252*).—The results of these investigations have been essentially noted from another source (E. S. R., 43, p. 115).

Utilization of apple surplus, L. Stanley and O. Davis (*Missouri Sta. Bul. 179 (1921), p. 37*).—The authors report that apple sauce, either with or without spice but with no sugar, can be dried into compact form in an oven at low temperature or in a current of heated air. On adding water and sugar and boiling for 3 or 4 minutes the resulting product is said to be very palatable and to have no dried-apple flavor.

Commercial utilization of grape pomace and stems from the grape-juice industry, F. Rabak and J. H. Shrader (*U. S. Dept. Agr. Bul. 952 (1921), pp. 24, figs. 10*).—This publication deals with the possibility of practicable and profitable commercial utilization of the waste from grape-juice factories. Methods are described for utilizing the stems as a source of cream of tartar, the skins for jelly, and the seeds for the manufacture of oil, meal, and tannin extract. Statistics obtained from grape-juice manufacturers of the eastern part of the country showed that the average quantity of grapes crushed for beverage purposes from 1914 to 1918 inclusive was 22,000 tons, and that an average of 660 tons was discarded in stems and 4,400 in wet pomace consisting of 75 per cent skins and 25 per cent seeds. From the above quantity of waste, it is calculated that 13.2 tons of cream of tartar, 19,800,000 8-oz. glasses of jelly, and 1,435 tons of dry residue of value as stock feed could be obtained annually. From the seeds about 89.3 tons of oil can be obtained by the pressure or expeller method, with 526.7 tons of oil cake and 48.4 tons of tannin extract. By the solvent extraction method the yield would be about 132 tons of oil and 963 tons of meal. The oil on refining is said to be a palatable edible product.

The costs and returns of the utilization of the waste as thus described have been calculated on prices prevalent during the winter of 1919–20.

Methods used in manufacturing unfermented grape juice, C. H. Campbell (*Canner, 51 (1920), Nos. 9, pp. 35, 36; 10, pp. 35, 36*).—A brief description is given of the various steps in the process of manufacturing Concord grape juice, together with analyses of juices from Concord, Ives, and Clinton grapes, of argol, and of grape pomace.

Flour milling and the cereal chemist, R. W. Mitchell (*Chem. Age [New York], 29 (1921), No. 3, pp. 85–89, figs. 2*).—This paper outlines briefly the functions and duties of the cereal chemist.

Plantation rubber and the testing of rubber, G. S. Whitby (*London and New York: Longmans, Green & Co., 1920, pp. [3]+XVI+559, pls. 8, figs. 48*).—This volume, which is one of the series of monographs on industrial chemistry edited by E. Thorpe, deals with the preparation and testing of plantation rubber. Data on the yearly world production of rubber, both plantation and wild, from 1906 to 1917 are presented in tabular form and also represented graphically, with the estimated annual percentage increase in the area of plantation rubber in bearing through 1922. An extensive bibliography is appended.

METEOROLOGY.

Meteorological tables, D. A. Seeley (*Mich. State Bd. Agr., Ann. Rpt. Sec. 58 (1919), pp. 143–156*).—Daily and monthly summaries of temperature (maximum, minimum, and mean), precipitation, cloudiness, and sunshine, and monthly summaries of pressure (maximum, minimum, and mean), wind movement, and miscellaneous phenomena (frost, hail, thunderstorms, fog, auroras, and halos) at East Lansing, Mich., are given for the year ended June 30, 1919.

[Temperature and rainfall at McNeill, Miss., Substation, 1903–1917], E. B. Ferris (*Mississippi Sta. Bul. 188 (1920), p. 23.*)—A table is given which shows the maximum and minimum temperature and rainfall of each month for the 15 years 1903–1917.

Climatic conditions [at Edgeley Substation, N. Dak.], O. A. Thompson (*North Dakota Sta. Bul. 145 (1921), pp. 3–8*).—Climatic conditions with reference to crop production at this place during the years 1914 to 1920, inclusive, are briefly described, and data for precipitation and temperature for each month from 1901 to 1920, inclusive, are summarized in tables. Data on evaporation as compared with precipitation during May, June, and July, 1907–1920, are also tabulated.

The data show that evaporation ranged during the growing months from an amount about equal to the precipitation in favorable seasons to slightly more than 30 times the precipitation in a dry hot period. "It has been observed that crop production very closely follows the relative ratio of evaporation to precipitation."

Analysis of the air of Sao Paulo, Brazil, B. de Mattos Filho (*Bol. Agr. [Sao Paulo], 21. ser., No. 12 (1920), pp. 821–846, figs. 8*).—The ozone, carbon dioxid, and moisture contents of the air of each day of July, August, and September, 1920, are reported.

British rainfall, 1919 [*(Gt. Brit.) Met. Off., Air Min., Brit. Rainfall Organ., 59 (1919), pp. XXVIII+268, pls. 2, figs. 36; rev. in Met. Mag.* [*London*], *55 (1921), No. 660, pp. 269, 270*).—This report summarizes in practically the same form as in previous years the results of 4,896 complete rainfall records. It also contains special articles on The Effect of Rainfall on the Saturation-Level in the Chalk at Chilgrove, West Sussex, from 1836 to 1919, by D. H. Thomson, and on The Exposure of Rain Gauges, by M. de C. S. Salter (E. S. R., 44, p. 209), a record of evaporation and percolation in 1919 at various places, and a discussion of the relation of evaporation records at Camden Square, from 1905 to 1918, to other meteorological elements. The distribution of rainfall is as usual considered at length, and a new feature of the report is the introduction of maps showing the distribution of the annual rainfall.

"It would appear to be abundantly clear that sunshine and temperature are the prime factors in promoting evaporation, any modification introduced by variations in the wind movement and rainfall being too slight appreciably to affect the high correlation."

SOILS—FERTILIZERS.

The chemical composition of the soils of the Camden area of New Jersey, A. W. Blair and H. C. McLean (*New Jersey Stas. Bul. 346 (1921), pp. 40, figs. 2*).—Chemical analyses of samples of the different soil types encountered in the Camden area of New Jersey, the physical survey of which has been previously noted (E. S. R., 37, p. 123), are reported and discussed.

It is stated that there are rather pronounced chemical differences between the soils of the different soil series encountered within the area. The Collington, for example, is characterized by the presence of more or less greensand marl and therefore contains a rather high percentage of potash, the Keansburg shows an unusually high percentage of all three fertilizing constituents, and the Freneau is high in phosphoric acid and potash. In the Shrewsbury the potash is notably higher in the subsoil than in the soil. The Hyde shows an exceptionally high percentage of nitrogen and also an excess of lime over magnesia. The Sassafras, on the other hand, usually shows an excess of magnesia over lime. The Lakewood is characterized by a pronounced deficiency in all three fertilizing constituents, in some cases only a trace of potash being reported. The soils of all series are deficient in available lime.

Generally speaking, those soils which contain the highest percentage of total plant food are those that are most productive and command the highest prices as farm lands. Exceptions to this are found in the poorly drained, heavy clay soils, and those that are highly acid. Following from the lighter to the heavier types through the different series, there is to be noted in general a gradual increase in the total plant food. There is invariably more nitrogen in the soil than in the subsoil. In most cases the amount in the former is at least two or two and a half times that in the latter. When averages are considered the difference between the mineral plant food content of the soil and the subsoil is not great, though in a number of cases there is more potash in the subsoil than in the soil.

The loams throughout the area are high in potash, the amount varying from 1 to as much as 4 per cent, with an average of 1.63 per cent for the soil, 1.9 per cent for the first subsoil, and 1.91 per cent for the second subsoil. With the exception of the Shrewsbury series the sands and sandy loams usually contain less than 1 per cent of potash.

Composition of the sugar-cane soils of the French Antilles, M. Rigotard (*Agron. Colon., 6 (1921), No. 38, pp. 44–52*).—Physical and chemical analyses of typical samples of sugar cane soils of the French Antilles are summarized and discussed.

The physical analyses show that most of these soils are either red or yellow siliceous clays and are very deficient in lime, but have a limy subsoil. The chemical analyses show that while the soils contain important total amounts of nutritive constituents, only a small percentage of these is available to crops, especially phosphoric acid.

[Plowing and subsoiling experiments at the Edgeley Substation], O. A. THOMPSON (*North Dakota Sta. Bul. 145 (1921), pp. 20–22*).—The results of eight years' trials of different methods of preparing land for a crop are reported. A continuous cropping system was used, and the only varying factors were the different methods of preparation. These included early fall plowing done near September 1, medium fall plowing done near October 1, late fall plowing done near November 1, and spring plowing and disking. In some cases the subsoil packer was used, and in other cases the soil was disked in the fall and plowed in the spring.

A comparison of the average yield from all the fall methods of tillage with the average of all the spring methods showed a difference of 3.2 bu. of wheat per acre in favor of the latter. Crops on the early fall plowed land gave the best yields, those on spring plowed land second best, and those on medium and late fall plowed land third best. Apparently no advantage was obtained from packing the land either in the fall or in the spring for cereal crops, and the indiscriminate use of the subsurface packer is not recommended.

In experiments in subsoiling and packing as methods of preparing the soil for durum and hard wheat, oats, and barley, it was the plan to subsoil the land once every four years in the subsoil plats and to fall plow the land 6 in. deep in all plats the remainder of the time. The average of six years' trials indicate that packing and subsoiling were of no benefit. Good 6-in. plowing gave as good yields as were obtained with 6-in. plowing plus subsoiling and 6-in. plowing plus subsoiling and packing.

[Soil bacteriology] (*Idaho Sta. Bul. 122 (1921), pp. 27, 28*).—Studies of Helmer silt loam soil from northern Idaho, which is deficient in ammonifying, nitrifying, and nitrogen-fixing powers, showed that the ammonifying and nitrifying efficiencies were increased approximately 400 per cent by the addition of 1 per cent of calcium carbonate.

Sawdust from kiln-dried lumber, including white and yellow pine, cedar, maple, ash, larch, red and white fir, needles and cones from the same trees, fern brakes, and forest floor, when added to soils of known fertility, reduced the ammonification of dried blood from 12 to 20 per cent. The retarding action was not entirely overcome by the addition of lime during the period of the experiment.

Samples of the same sawdust were added to a rich garden soil and a field soil to determine the effect on the nitrifying of blood. The result with the garden soil showed a reduction in nitrate formation varying from 17 to 24 per cent. The reduction in the case of the field soil varied from 5 to 49 per cent in the presence of 1 per cent of wood and from 5 to 78 per cent in the presence of 2.5 per cent of wood. Cedar persistently exerted the greatest retarding influence. Of the various products added, fern brakes caused the least reduction in nitrate formation, which varied from 4 to 11 per cent, while cedar needles proved the most toxic, reducing nitrate formation from 32 to 76 per cent.

These results are taken to indicate that the lack of productivity of Helmer silt loam is due to the accumulation of by-products from the forest which exerts an unfavorable influence on bacterial activities. Studies of the effects of woods and forest products on nitrogen fixation, in which something like a thousand Kjeldahl nitrogen determinations were made, showed that all conifers have an inhibitory action upon the nitrogen-fixing powers of soil bacteria, cedar being the most deleterious, followed by red fir, larch, and white and yellow pine. With age and the starting of decomposition processes this toxicity was materially reduced. Ash and maple stimulated the fixation of free nitrogen. Concentrations of cedar needles as low as 0.1 per cent per 100 gm. of mannite solution proved toxic, and higher concentrations practically eliminated all nitrogen fixation by bacteria.

[Soils and soil biology] Z. NORTHRUP [WYANT] (*Michigan Sta. Rpt. 1919, pp. 236–238*).—Experiments with a series of composts, consisting of various proportions of peat and manure on a nearly pure sand soil growing Canada field peas, showed that the pure peat gave the best results, and the yields decreased as the percentage of peat decreased. This is attributed merely to the water-holding capacity of the peat.

Studies of composts of peat, manure, and rock phosphate to which sufficient liquid manure was added to insure anaerobic conditions showed that large numbers of both aerobic and anaerobic cellulose-decomposing organisms were present and were increasing. Organisms concerned in the dissolution of rock phosphate were present quite frequently in considerable numbers. Analyses of material from the pit showed that there had been an increase of about 8 per cent in the citrate-soluble phosphoric acid in a period of nine months, but a decrease in total phosphorus of about 20 per cent, which is accounted for by the presence of large amounts of soluble phosporus in the drainage water. Azotobacter were found not only in the surface samples but in the bottom samples, which had existed for over nine months under decidedly anaerobic conditions.

Daily periodicity in the numbers of active soil flagellates, with a brief note on the relation of trophic amoebae and bacterial numbers, D. W. CUTLER and L. M. CRUMP (*Ann. Appl. Biol., 7 (1920), No. 1, pp. 11–24, figs. 8*).—Studies of the protozoa and bacteria in the soil of a fertilized wheat field at the Rothamsted Experimental Station are reported, which indicated that there is a daily fluctuation in the number of trophic forms of the three species of flagellates, *Oicomonas* sp. (Martin), *Cercomonas longicauda*, and *Bodo* sp., in the soil of arable fields. The numbers of bacteria and trophic amoebae in the soil were found to be correlated, varying inversely over a period of 14 days. Temperature and rainfall appeared to have no influence on the numbers of active protozoa in the soil.

Bacteriological studies of alkali soils, W. G. SACKETT (*Colorado Sta. Rpt. 1920, p. 21*).—Studies of the bacteria from the Book Cliff and Mesa Verde sandstones to determine their ability to fix atmospheric nitrogen, both in pure cultures and when associated with one another, showed that although the amount of nitrogen fixed is small, the fixation is consistent. Associative action appears to be of no importance in this process. Rock lichens were shown to be capable of satisfying all carbon requirements. Fourteen pure cultures and their combinations were examined in this study.

The natural inoculation of Colorado soil with legume bacteria, W. G. SACKETT (*Colorado Sta. Rpt. 1920, p. 22*).—Representative samples of Colorado soils from both dry and irrigated sections were planted with numerous different legumes, and after six weeks the plants were examined for nodules. Tests of 45 soils have given results indicating tentatively a rather general and natural inoculation for alfalfa, sweet clover, and vetch and the need of inoculation for peas and beans.

Acidity influences inoculation and growth (*Wisconsin Sta. Bul. 323 (1920), p. 55, fig. 1*).—Studies by O. C. Bryan and E. B. Fred showed that cowpeas and soy beans dropped off markedly in both growth and nodule formation as soon as an excess of either acid or alkali appeared in the soil. Corn, on the other hand, made a reasonably satisfactory growth even under acid conditions which were sufficient to stunt and prevent the inoculation of the roots of both soy beans and cowpeas.

Are legume bacteria killed by freezing? (*Wisconsin Sta. Bul. 323* (*1920*), *p. 36*).—Experiments conducted by E. B. Fred indicated that legume bacteria are able to live through the winter and will withstand winter temperatures, and also that bacteria planted with the seed in early spring will be able to induce nodule formation.

Nitrate production in field soils in Illinois, A. L. WHITING and W. R. SCHOONOVER (*Illinois Sta. Bul. 225, abs.* (*1920*), *pp. 4*).—This is an abstract of Bulletin 225 of the station, previously noted (E. S. R., 43, p. 214).

Green manure for soil improvement (*Wisconsin Sta. Bul. 323* (*1920*), *pp. 53–55, fig. 1*).—Experiments by A. R. Whitson and F. L. Musbach showed that the influence of the green manuring crop in a 4-year rotation of corn, potatoes, oats, and clover is greater during years following seasons favorable to its growth. The good effect of green manure was found generally to increase when the rotation had been in progress until two or three manuring crops were added to the soil.

Studies on the relations between soil moisture, plant development, and nutrition, E. HASELHOFF (*Landw. Vers. Sta., 89* (*1916*), *No. 1, pp. 1–31*).—Preliminary studies on the subject are reported, which established the existence of narrow relations between soil moisture, nutrient assimilation, and crop yield, but apparently did not justify the drawing of specific conclusions.

Investigations on the determination of the active value of soil phosphoric acid and potash by cropping experiments and the determination of their relative solubility by acids, O. LEMMERMANN, A. EINECKE, and L. FRESENIUS (*Landw. Vers. Sta., 89* (*1916*), *No. 2–3, pp. 81–195, pls. 2*).—These studies are reported as a contribution to the basic knowledge of soil analysis, which is apparently not considered to be as yet sufficiently complete to permit the drawing of final conclusions.

It was found in these experiments that the physiologically active value of phosphoric acid and potash compounds in soils could usually be suitably expressed by a determination of their relative solubilities. Such determinations are therefore recommended for the judgment of soils, as they represent the actual value of these soil nutrients better than a simple determination of the percentage content of the soil in potash and phosphoric acid by a single solvent.

A 1 per cent solution of citric acid proved to be the best solvent for determining the relative solubility of soil phosphoric acid. This solvent was too weak for potash, better results being obtained with 10 per cent hydrochloric acid. It was possible to disregard the influence of the physical character of the soil in the method used. Also in comparing the solubilities of nutrients in light and heavy soils, it was found that the potash compounds of the better soils were not more difficultly soluble than those of the lighter soils. The opposite was true for phosphoric acid, which is attributed to the higher percentages of iron and clay in the better soils. Crops appeared to utilize phosphoric acid relatively better from soils more deficient in that nutrient.

Soil-fertility experiments on Dekalb, Volusia, and Westmoreland soils, J. W. WHITE and F. J. HOLBEN (*Pennsylvania Sta. Bul. 166* (*1921*), *pp. 23, figs. 5*).—The nature, objects, scope, and progress results of soil-fertility experiments being conducted on three typical soils of Pennsylvania are presented in this report. The experiments are intended to test the comparative value of different forms, combinations, and amounts of commercial fertilizers, lime, and manure in the production of the more common farm crops grown in the State. The three series of experiments at present include 18.4 acres divided into 152 plats.

It has been found that acid phosphate is the most effective single fertilizer treatment for the unproductive Dekalb soil, and together with lime it appears to be the foundation for a system of permanent agriculture on this extensive soil area. On the basis of equal amounts of phosphoric acid, acid phosphate during the first rotation was found to be over five times as effective as rock phosphate. The first two years' results on the Volusia soil indicate that lime is indispensable in the scheme of soil improvement, since 90 per cent of the Volusia soils are acid. The utilization of the manure from the dairy industry to the best advantage is considered to be of first importance on this soil, and the increased value of manure through the use of lime and phosphoric acid has been demonstrated. No definite recommendations are given for the Westmoreland soil.

Soils (*Missouri Sta. Bul. 179* (*1921*), *pp. 49–55, figs. 4*).—The results of 30 years of crop rotation and fertilizer experiments are summarized by M. F. Miller and F. L. Duley, showing that crop rotation on corn has been more effective in maintaining the yield where no manure has been applied than has continuous corn with manure. The same result was obtained with wheat. It is also noted that heavy applications of commercial fertilizers have been practically as effective in maintaining the yield of wheat under continuous cropping, and the yield of all crops in a 6-year rotation, as has the heavy use of stable manure.

Experiments to determine the best systems of soil management for the most important soil types in Missouri, conducted by M. F. Miller, F. L. Duley, and O. B. Price, showed that the so-called legume treatment has brought no financial returns, and that rock phosphate applied with manure has given good results on certain fields of wheat. The small response from other crops, however, has made this application uneconomical.

Studies of nitrate production in soil as affected by cropping and cultivation were continued by W. A. Albrecht, showing that early spring tillage, particularly plowing, increased the nitrate content. Of all treatments studied, the straw mulch produced the most significant effects in holding down nitrate production.

Report of the Golden Valley peat experimental fields, 1918 and 1919, F. J. Alway (*Minnesota Sta. Bul. 194* (*1920*), *pp. 5–116, figs. 37*).—The results of the first two seasons' work on the experimental peat fields of Golden Valley, which are typical of the high-lime, grass, and sedge-covered bogs of northwestern Minnesota, are reported.

It has been found that the unproductivity of this peat is due to a lack of available phosphoric acid. When this was supplied, good yields of most crops adapted to that section of the State have been obtained, otherwise only flax gave satisfactory yields. The natural supply of lime is abundant, and the nitrogen becomes available rapidly enough for ordinary farm crops. During the first two years potash showed no distinctly beneficial effects either alone or in combination with phosphate. The burning of the surface layer of peat to provide phosphoric acid, while possible, is not recommended owing to the many disadvantages and danger connected with the practice.

It is recommended that farmers who have peat land naturally covered with grass use a phosphate fertilizer containing either from 300 to 400 lbs. per acre of acid phosphate or one-third as much of triple superphosphate.

Experiments on maintaining soil fertility on Edgeley loam [at the Edgeley Substation], O. A. THOMPSON (*North Dakota Sta. Bul. 145 (1921), pp. 38, 39*).—A set of crop rotations begun in 1913, which were designed to determine the profitableness of a live-stock farming system and a cash-crop farming system, is described and the results to date reported.

In the live-stock system a 4-year rotation, consisting of corn, wheat, oats, and sweet clover, was used and manure and commercial fertilizers applied. The cash-crop farming system included a rotation of potatoes, wheat, barley, and sweet clover, and green manure and commercial fertilizers were applied. It was found that as an average of seven years, manure alone increased the yield of corn 0.45 ton per acre, or 17.3 per cent. As a 6-year average, manure increased the yield of wheat 1 bu., or only 6.5 per cent. The influence of soil treatment on the yield of oats was negligible. There was no evidence that the use of commercial fertilizers produced any increase over and above that produced by manure. As an average of eight years, green manuring increased the yield of potatoes 8.3 bu. per acre, or 8.9 per cent.

[Soil investigations], F. J. SIEVERS (*Washington Sta. Bul. 158 (1920), pp. 33, 34*).—Soil-fertility studies in western Washington indicate conclusively that most acid soils are deficient in phosphorus, and that application of lime alone generally gives poor results unless it is supplemented with a phosphate fertilizer. Indications are that much of the difficulty experienced in growing clover is due more to the deficiency in phosphorus than to soil acidity.

Data from crop rotation work show that peas can be used to good advantage as a nurse crop for alfalfa and sweet clover.

Studies of orchard soils showed that in all the irrigated tracts there must be sufficient water available not only to supply the quantity necessary for bearing trees, but also to provide for the growing of a legume between the trees. The virgin nitrogen supply in irrigated orchard tracts is said to be exceedingly low, and successful yields depend upon the maintenance and increase of this supply.

A complete fertilizer for Savannah cranberry land, C. S. BECKWITH (*New Jersey Stas. Circ. 124 (1921), pp. 4, fig. 1*).—Studies to determine proper fertilizer treatment for cranberry soils are briefly reported and discussed.

It was found that sodium nitrate and dried blood were the best sources of nitrogen, while ammonium sulphate and calcium cyanamid were undesirable. Raw rock phosphate and acid phosphate both gave good results. Potash gave small increases and seemed most advantageously applied as potassium sulphate. On the basis of these results, information is given for popular use on the proper fertilizer formula to be used on such soils.

New way for the use of sewage sludge as fertilizer, M. STRELL (*Landw. Vers. Sta., 90 (1917), No. 3-4, pp. 257-268*).—Experiments are reported, the results of which are taken to indicate that the nitrification of the organic nitrogen compounds of sewage and stable manure is hastened by mixing certain humus-containing substances with them. In this connection the author describes his experience with a brown coal humus product mixed with canal sewage.

Is phonolite a nitrogeneous fertilizer? E. BLANCK (*Landw. Vers. Sta., 90 (1917), No. 1-2, pp. 33-47*).—Experiments are reported from which the conclusion is drawn that phonolite does not act as a nitrogenous fertilizer.

Recovery of potash alum and sulphur at Tonopah [Nev.], L. DUNCAN (*Chem. and Metall. Engin., 24 (1921), No. 12, pp. 529, 530, figs. 4*).—The process and plant used in the recovery of potash alum and an agricultural grade of sulphur by extraction and flotation are described.

The solubility of different phosphates and their utilization by oats and buckwheat, T. PFEIFFER, W. SIMMERMACHER, and M. SPANGENBERG (*Landw. Vers. Sta., 89 (1916), Nos. 2–3, pp. 203–230 pl. 1*).—The results of a continuation of experiments previously noted (E. S. R., 35, p. 428) confirmed those of the first experiments, and showed that an addition of calcium carbonate decreased the utilization of difficultly soluble phosphates. Raw phosphate proved to be a good fertilizer on acid soils. Buckwheat, while having a weaker root system than oats, again assimilated more phosphoric acid from difficultly soluble phosphates. An artificial introduction of carbon dioxid into the soil did not make plant nutrients more available.

A greater water utilization per unit weight of increase in dry matter took place when coral rock phosphate was used. This is thought to be possibly due to the fluorin content of the phosphate. A corresponding addition of calcium fluorid produced no results, but an addition of ammonium fluorid slightly injured the growth of oats. It is concluded that the fluorin content of the coral rock phosphate can not account for the poor results obtained from its use with oats.

Lime maintains availability of phosphates (*Wisconsin Sta. Bul. 323 (1920), pp. 55, 56*).—Experiments by E. Truog and F. W. Parker indicated the value of lime in the soil in keeping phosphates in available form. As the amount of lime in the soil decreases, conditions were found to permit the formation of the less available iron phosphates.

Laboratory trials with rape and corn showed that liming greatly increased the availability of phosphate in acid soil.

Soil fertility experiments (*North Dakota Sta. Bul. 146 (1921), p. 14*).—The progress results of a comparative study of raw rock phosphate, steamed bone meal, and acid phosphate as supplementary fertilizers in live-stock and cash-crop farming systems on Fargo clay soil showed that the acid phosphate gave somewhat more beneficial average results than either steamed bone meal or raw rock phosphate. These differences in the effects of the various forms of phosphate were small, however.

An improved scheme for determining unexhausted manurial values, J. HENDRICK (*Highland and Agr. Soc. Scot. Trans., 5. ser., 32 (1920), pp. 1–34*).—The author discusses in some detail some of the important proposals contained in the report of the committee on compensation for manurial improvements and so-called cumulative fertility, appointed under the Agricultural Holdings Act of Scotland of 1908. The text of the report discussed is appended.

Liming, H. GLØMME (*K. Selsk. Norg. Vels Jordbundsutvalg. Smaaskrifter No. 10 (1920), pp. 104*).—Several series of experiments to study the action of lime in soils when used in practical agriculture are described. These included work on soils varying from clays and sands to loams and peat. The proper time of liming pastures and methods of determining lime requirements were also studied. Liming generally produced increases in both potato and grain crops of clay, sand, and peat soils, but not on moraine and black soils. A bibliography is appended.

Special fertilizer analyses, 1920, R. E. ROSE and G. HART (*Fla. Dept. Agr. Quart. Bul., 31 (1921), No. 1, pp. 44–83*).—This section of this report contains the results of special analyses of 413 samples of fertilizers and fertilizer materials taken by purchasers in Florida during the calendar year 1920, and the results of official and guarantied analyses of 47 samples collected for inspection under the terms of the State fertilizer law.

[Analyses of commercial fertilizers, ground bone, and agricultural lime], C. S. CATHCART ET AL. (*New Jersey Stas. Bul. 349 (1920), pp. 5–45*).—This bulletin contains the results of actual and guarantied analyses of 898 samples of fertilizers and fertilizer materials and of 13 samples of lime and limestone collected for inspection in New Jersey during the fall of 1920, together with registrations for the year.

AGRICULTURAL BOTANY.

Outline of the history of botany, R. J. HARVEY-GIBSON (*London: A. & C. Black, Ltd., 1919, pp. X+274*).—This brief sketch of the history of botany indicates the substance of a course of lectures given to students of the University of Liverpool during their third year of residence, and has for its object the discussion of the more important features in the advance of botanical knowledge from the earliest times to the present. Reference is made to contributions by about 50 authors.

The quantitative method in biology, J. MACLEOD (*Manchester: Univ. Press; New York: Longmans, Green & Co., 1919, pp. XII+228, figs. 27*).—In view of the fact that variability has been hitherto the great obstacle which has rendered impossible the general use of quantitative data (figures) in biological sciences, the author aims to describe a method by which biological constants may be established.

The first two chapters set forth certain theoretical views regarding the concepts of species and variation. These views afford a guide for the discovery of primordia, or elementary properties or characters, which are to be measured in order to find constants. The constants themselves are, however, entirely independent of any theory and of any calculation whatever, each being a direct expression of an observed fact.

Radioactivity and normal physiological function, V. H. BLACKMAN (*Ann. Bot. [London], 34 (1920), No. 135, pp. 299-302*).—A brief statement and discussion of the data obtained by H. Zwaardemaker[1] are given, in view of their supposedly fundamental importance to plant as well as animal physiologists.

It is thought possible that the importance of potassium in the life of the plant may be in part explained by its radioactive power. In the minuteness of the dose of the heavy radioactive elements required, as compared with that of potassium, and in the ease with which a toxic concentration is reached, may lie the explanation of the conflicting results obtained by the addition of radioactive earths to soil.

Plant physiology (*Idaho Sta. Bul. 122 (1921), pp. 44, 45*).—Progress reports are given of investigations on the development of the apple and on the enzymatic processes taking place in the apple at various stages in its development. Tests were made for the presence of diastase and invertase in the apple at different stages of growth, but all the results were negative.

In studying the growth of the apple it was found that the fruit is made up of a large mass of parenchymatous cells which appear to be fully formed at an early stage of its growth, and the increase in size appears to be mainly due to an enlargement of existing cells. Starch appears early in the growth of the apple and is deposited throughout the growing season. During the ripening period starch disappears, and in fully ripened apples little or no starch is to be found.

Plant growth and carbon dioxid, H. FISCHER (*Naturwissenschaften, 8 (1920), No. 22, pp. 413-417*).—This brief discussion of work in part previously reported (E. S. R., 42, p. 137) deals with the practical possibilities involved in supplying more than the normal air content of carbon dioxid to growing plants.

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[1] Jour. Physiol., 53 (1920), No. 5, pp. 273-289.

Field studies of the carbon dioxid absorption of coconut leaves, F. T. McLean (*Ann. Bot.* [*London*], *34* (*1920*), *No. 135, pp. 367–389, pl. 1, figs. 9*).—The method here described for field studies of carbon dioxid absorption by leaves is considered satisfactory for comparative studies of the rates of carbon dioxid absorption by different leaves, by the same leaves at different times, and by the leaves of different kinds of plants.

Middle-aged leaves absorb carbon dioxid faster than either immature or old leaves. The rates of absorption of carbon dioxid by attached coconut leaves show a maximum rate in the morning, a depression at midday, and a second rise in the afternoon, followed by a final declination toward sunset. Detached pinnae of coconut absorb carbon dioxid at the same rate as attached leaves, but the maximum occurs at a different hour. Apparently sugar cane absorbs carbon dioxid much more rapidly than coconut under these conditions.

A method of preparation and some properties of a starch gel, C. L. Carey (*Bul. Torrey Bot. Club, 47* (*1920*), *No. 10, pp. 455–463*).—The preparation of this starch gel was undertaken with the idea of obtaining a pure carbohydrate gel which on account of its hydrative capacity would be suitable for experimentation under various conditions. This method is offered as a means of preparing a fairly resistant starch gel which is easily handled.

Osmotic properties of some plant cells at low temperatures, F. J. Lewis and G. M. Tuttle (*Ann. Bot.* [*London*], *34* (*1920*), *No. 135, pp. 405–416, figs. 10*).—Determinations have been made of osmotic pressures, electrical conductivities, proportions of electrolytes and nonelectrolytes, and of sucrose, maltose, and glucose in the leaf tissues of *Picea canadensis*, *Linnaea borealis*, and *Pyrola rotundifolia*, and in the cortical tissues of *Populus tremuloides* at intervals from autumn until summer.

It is thought that no certain correlation between the values found and the daily or weekly fluctuations of air temperatures can be established without observations extending over more than one season.

The freezing point of potatoes as determined by the thermoelectric method, R. C. Wright and R. B. Harvey (*U. S. Dept. Agr. Bul. 895* (*1921*), *pp. 7, fig. 1*).—The results are given of a study of the freezing point of 18 standard varieties of potatoes grown under the same conditions, a thermoelectric method being used for the determination.

It was found that the freezing point of potatoes tends to rise as the season advances. It seems to vary with varieties, and in the same family group of potatoes the freezing point of different varieties is often comparable. Early and mid season varieties are said to have a higher freezing point than late varieties.

Freezing injury to potatoes when undercooled, R. C. Wright and G. F. Taylor (*U. S. Dept. Agr. Bul. 916* (*1921*), *pp. 15, pl. 1, fig. 1*).—In this investigation of the injury to potatoes due to exposure to temperatures below the freezing point, it was found that potatoes freeze more quickly when exposed to rapidly diminishing temperatures than when the temperatures diminish slowly. Potatoes can be undercooled several degrees below their true freezing point, then warmed again above the freezing point without freezing injury, provided no ice formation takes place. When undercooled, jarring resulting from rough handling or incidental to hauling is liable to cause potatoes to freeze. After freezing commences it is progressive, and the amount of injury caused within a stated time is said to depend upon the surrounding temperature. In undercooled potatoes, when freezing has once begun, the temperature of the potatoes is said to rise to its true freezing point and remains at that temperature for a varying length of time, depending upon the surrounding temperature.

Uptake of water by detached twigs, T. Matsushima (*Jour. Col. Sci. Imp. Univ. Tokyo, 43 (1919), Art. 2, pp. 27, figs. 2*).—Decrease of water uptake at the cut end of a twig cut off in air is unimportant in plants which contain much woody material, but considerable in plants containing milk, slime, or gum. Burning the cut end, especially in the latter of these two general classes, favors water uptake; charring the cut end preventing entirely the stoppage of the water-carrying vessels. Acids (particularly organic) favor, while alkalis hinder, the absorption of water, these conditions being reversed in case of milk-, slime-, or gum-bearing twigs.

The growth of Lemna plants in mineral solutions and in their natural medium, W. B. Bottomley (*Ann. Bot. [London], 34 (1920), No. 135, pp. 345–352*).—Experimentation is claimed to have shown, in case of *Lemna minor* and *L. major*, that these plants are unable to sustain healthy growth for any length of time on Detmer's solution or Knop's solution, though the addition of organic matter promoted health and multiplication and accelerated growth in these plants. The organic matters thus shown to be essential to metabolism are found in the pond waters in which the plants grow normally, although lack of sufficient nitrates and phosphates acts as a limiting factor retarding multiplication.

The effect of organic matter on the growth of various water plants in culture solution, W. B. Bottomley (*Ann. Bot. [London], 34 (1920), No. 135, pp. 353–365, pl. 1*).—The results from these experiments corroborate those above noted, in that organic matters were necessary to supplement nutrient inorganic solutions.

The substances effective in promoting growth and health were found to be present in an autoclaved growth of *Azotobacter chroococcum*, crude nucleic acid derivatives from raw peat, and a water extract of bacterized peat. Other plants experimented with are said to have responded in the same general ways as did the plants above mentioned. Throughout the experiment it was found that the more rapid the rate of multiplication of the plants, the quicker was the response to the addition of organic substance to the solution.

The relation between the number of bacteria and acid production in the fermentation of xylose, J. A. Anderson, E. B. Fred, and W. H. Peterson (*Jour. Infect. Diseases, 27 (1920), No. 4, pp. 281–292, figs. 3*).—This article is concerned primarily with the rate at which by-products are formed and their relation to the number of bacteria, in order to study the mechanism of fermentation reactions. The experiments described were made with *Lactobacillus pentoaceticus* in an attempt to determine the relations between the number of bacteria present and the rate of acid production during the fermentation of xylose.

The results show that the fermenting capacity of a culture is determined by the number and age of the bacteria present. The rate of acid production is most rapid during the period of maximum growth of the bacteria, though a slow acid formation is noted for many days. Apparently, acetic acid is the only volatile acid produced in the fermentation of xylose by *L. pentoaceticus*.

The biological significance of tannic substances, A. de Dominicis (*Staz. Sper. Agr. Ital., 52 (1919), No. 7–9, pp. 305–331*).—This is a report of a study on the variations in the content of tannic substances, chiefly in the cortex of chestnut, at different periods. Tannic substances in the glucosid stage are supposed to represent waste products easily destroyed, and utilizing in their destruction the process of combustion in the plant.

The effect of zinc sulphate on protoplasmic streaming, H. M. Rusk (*Bul. Torrey Bot. Club, 47 (1920), No. 9, pp. 425–431, figs. 2*).—Results of this study, as carried out with leaf cells of *Elodea canadensis* and with cells from an uncorticated Chara, are offered as evidence in favor of the view that very dilute poisons act as stimulants to plant cells.

A study of the metabolism of roots, W. J. Robbins and W. E. Maneval (*Missouri Sta. Bul. 179 (1921), p. 22*).—The authors have been carrying on investigations to determine whether any material is necessary for the growth and development of the roots of plants in addition to the essential mineral salts and water obtained from the soil solution, oxygen from the air, and carbohydrates from the plant top. A method is said to have been developed whereby the growth of root tips can be maintained under sterile conditions.

A simple root auxanometer, W. N. Jones (*Ann. Bot. [London], 34 (1920), No. 136, pp. 555–557, fig. 1*).—An auxanometer, claimed to be in practice sufficiently simple for elementary studies and at the same time sufficiently accurate for more serious purposes, is described as to form, construction, and procedure.

Studies in seed germination, A. W. Hill (*Ann. Bot. [London], 34 (1920), No. 136, pp. 417–429, pl. 1, figs. 15*).—Evidence is offered to show that the rudimentary curved body lying opposite the cotyledon in the Cyclamen embyro is the second cotyledon, and that under ordinary conditions it does not develop to form a green leaf. The Cylamen seedling, though aberrant in type, is thus seen to be truly dicotyledonous in its nature.

The rôle of the seed coat in relation to the germination of immature seed, F. Kidd and C. West (*Ann. Bot. [London], 34 (1920), No. 136, pp. 439–446, fig. 1*).—The present paper is claimed to show that in case of *Brassica alba* and of *Pisum sativum* the removal of the testa not only accelerated the germination and terminated the dormant condition of unripe seeds, but also increased the germination percentage.

Study of factors influencing the rest period of horticultural plants, H. D. Hooker, jr. (*Missouri Sta. Bul. 179 (1921), pp. 39, 40*).—Analyses were made of fruit buds that survived the winter's cold and of buds that were killed. The analyses of peach and cherry buds showed that the surviving buds had a low ether extract, but a relatively high content of nitrogen, phosphorus, and potash. Analysis of comparable samples from the peach, including the node with the bud, showed the surviving buds to have a low moisture, acidity, and nitrogen content, but a high starch content. Starch is said to be stored in the leaf gap and consequently does not figure in the analysis of buds alone.

Natural death of plants, F. Weber (*Naturw. Wchnschr., 34 (1919), Nos. 32, pp. 449–457; 33, pp. 465–471*).—Citations and discussions are presented regarding the views held by various authors, along with some of the underlying data.

Further studies in the ecotone between prairie and woodland, R. J. Pool, J. E. Weaver, and F. C. Jean (*[Nebr.] Univ. Studies, 18 (1918), No. 1–2, pp. 7–53, pls. 2, figs. 15; also Nebr. Univ., Bot. Survey Nebr., n. ser., No. 2 (1918), pp. 47, pls. 2, figs. 15*).—The object of this paper, which is a sequel to that by Weaver and Thiel already noted (E. S. R., 38, p. 521), is to record the results and conclusions derived from another season's investigations of some of the fundamental problems connected with the ecology of the areas lying within the vegetative borderlands between the prairies and the woodlands of the Missouri Valley in Nebraska.

"This paper contributes data which still further substantiates the conclusions drawn from previous investigations that evaporation rates and soil moisture conditions in the various plant communities studied vary in general directly with the order of the communities in succession, the communities nearest the climax being the most mesophytic in both respects. . . .

"Ecological conditions are shown to change rapidly as the forest-prairie ecotone is traversed in Nebraska. . . . It is thus shown that the natural extension of our native woodlands is greatly hindered, possibly altogether prevented in so far as any significant permanent extension is concerned, by the increasing severity of natural environmental conditions as we move westward away from the woodland types of southeastern Nebraska."

The high saturation deficit and the low soil moisture content (often reaching the nonavailable point) of the prairie sites in eastern Nebraska constitute barriers over which forest trees can scarcely pass. This gives probably the most ready explanation as to why natural Nebraska woodlands are confined to the moist slopes of rather narrow valleys, and also the most probable answer to the question as to the treelessness of the prairies in general.

Plant invasions of New Zealand with reference to Lord Howe, Norfolk, and the Kermadec Islands, J. C. Willis (*Ann Bot.* [*London*], *34* (*1920*), *No. 136, pp. 471–492, figs. 3*).—This is a study involving the application of the age and area theory to the floras of the islands outlying between New Zealand and the nearest larger areas of land to the north or northwest. It is claimed to be equally applicable to them, and to show that these islands probably once formed part of a land mass or masses running down to New Zealand from Indo-Malaya. Lists are given of the New Zealand genera showing supposed plant invasions; of the genera of the islands, showing those that reach New Zealand; and of the endemics of the islands. It is claimed that the plant invasions of New Zealand were probably four in number, northern, Kermadec, western, and southern.

The relative efficiency of cross and of self fertilization in some plants, Y. Emoto (*Jour. Col. Sci. Imp. Univ. Tokyo, 43* (*1920*), *Art. 4. pp. 31, pls. 2, figs. 6*).—Detailed studies are noted as bearing on the efficiency of cross and of self fertilization in *Primula sinensis*, *P. obconica*, *Brassica campestris chinensis*, and other plants.

[Chromosomes], T. Sakamura (*Jour. Col. Sci. Imp. Univ. Tokyo, 39* (*1920*), *Art. 11, pp. 221, pls. 7, figs. 24*).—This is an account of experimental studies on cell division and nuclear division, with particular reference to the forms, sizes, and numbers of chromosomes. An extensive bibliography is appended.

The chromosome number of Zea mays, Y. Kuwada (*Jour. Col. Sci. Imp. Univ. Tokyo, 39* (*1919*), *Art. 10, pp. 148, pls. 2, figs. 3*).—This is a contribution to the hypothesis of chromosome individuality and on the descent of *Z. mays*. A bibliography of more than 100 titles is appended.

New species of Uredineae, XII, J. C. Arthur (*Bul. Torrey Bot. Club, 47* (*1920*), *No. 10, pp. 465–480*).—Study of herbarium material subsequent to that previously noted (E. S. R., 43, p. 222) has resulted in the separation of new forms and correction of errors, which are indicated.

FIELD CROPS.

[Report of field crops work in Idaho, 1920] (*Idaho Sta. Bul. 122* (*1921*), *pp. 23, 53, 56, 59, 60, 61*).—Further progress of work previously noted (E. S. R., 41, pp. 225, 226) is reported.

Results of cultural tests with field peas show early seeding, drilled at a medium depth at the rate of 120 lbs. per acre, to give maximum yields. Field peas excelled small grains as a nurse crop for sweet clover. In rate of seeding tests with sweet clover, 15 lbs. of scarified seed gave the maximum yield and quality of hay the second season of growth. Studies of the relation of age of corn to yield of silage indicated the need of early planting for late-maturing varieties, while with acclimated varieties later plantings gave the highest silage yields.

At Aberdeen Substation, where sunflowers were drilled and spaced 18, 12, and 6 in. in the row, 18 in. spacing led in quality and yield, producing 28.5 tons per acre as compared with 24.3 tons from unthinned.

Alfalfa seeded in corn beginning to tassel, the field being then irrigated immediately and kept wet until the seed had germinated, produced good stands at the Caldwell Substation. Variety tests of cereal, forage, and silage crops at the Felt High Altitude Substation and the Sandpoint Substation are also noted.

[Report of field crops work in Louisiana, 1920], W. C. TAGGART, A. F. KIDDER, and G. D. CAIN (*Louisiana Stas. Rpt. 1920, pp. 8, 11, 12, 13, 14*).—The continuation of work noted heretofore (E. S. R., 43, p. 635) is described. Variety trials of sugar cane at the Sugar Station showed the juice of L-511 to contain 14.75 per cent sucrose as compared with 12 per cent for D-74 and 11.75 per cent for Purple. L-511 continued to show marked resistance to the mosaic disease. Fertilizer tests are also briefly noted.

At Baton Rouge, soy beans seeded in corn at the last cultivation in a rotation of cotton and corn gave an increase of about 100 per cent in both cotton and corn. In practically all cases, corn varieties planted at the rate of 6,000 stalks per acre produced more corn than when planted at the rate of 7,000 and 8,000 stalks per acre.

The leading field-crop varieties at the North Louisiana Station included Calhoun Red Cob corn, New Era cowpea, Mammoth Yellow soy bean, and Osceola velvet bean.

[Report of field crops work in Michigan, 1919), J. F. COX (*Michigan Sta. Rpt. 1919, pp. 286-318, figs. 11*).—The progress of work along the same general lines as noted heretofore (E. S. R., 41, p. 636) is reported. A brief account of plant-breeding work and a detailed discussion of the methods used and results secured in the improvement of the oat crop at the station from 1900 to 1919, by F. A. Spragg, are also included.

[Field crops work at McNeill, Miss., Substation, 1912-1917], E. B. FERRIS (*Mississippi Sta. Bul. 188 (1920), pp. 9-18, 20-22*).—This supplements earlier work (E. S. R., 28, p. 230) for the period 1912 to 1917, inclusive.

Detailed results of work with cotton have been noted already (E. S. R., 29, p. 35; 31, p. 136). The crop is not recommended for culture in the two tiers of Mississippi counties nearest the Gulf on account of excessive rainfall and the boll weevil. Tests of commercial fertilizers with corn and cotton indicated that land in this section could not be cropped economically without the aid of live stock and the resultant manure. Hastings Prolific, Vardaman, and Tennessee Red Cob, with respective acre yields of 34, 37.2, and 33.4 bu., led the corn variety tests in 1912, 1913, and 1914, respectively. Results with sorghums and other forage crops (E. S. R., 39, p. 230), and velvet beans (E. S. R., 38, p. 342), have been noted heretofore. Notes are also given on variety tests with oats and sweet potatoes, and the yields for 1903 to 1913, inclusive, of seed cotton, oat hay, pea hay, and corn in rotation tests are tabulated without conclusions.

Land subsoiled to a depth of 30 in. with dynamite yielded 9,886 lbs. of corn silage and 1,840 lbs. of oat hay per acre, while that not subsoiled made 11,448 lbs. of silage and 1,410 lbs. of hay. These and previous results indicated that the practice of subsoiling the land in question was not worth the expense involved.

[Report of field crops work at South Mississippi Substation, 1918-1920], E. B. FERRIS (*Mississippi Sta. Bul. 194 (1920), pp. 8-23*).—Work with field crops at the South Mississippi Substation at Poplarville is reported for the years indicated, continuing that conducted at McNeill noted above. The experiments included variety and fertilizer tests with cotton, corn, and sweet potatoes, spacing tests with cotton, and trials of nitrogen carriers. The results of the several tests are tabulated and discussed. The information included on cotton growing in south Mississippi has been noted from Bulletin 196 (E. S. R., 45, p. 129).

[Report of field crops work in Missouri, 1919–20], W. C. Etheridge, C. A. Helm, and L. J. Stadler (*Missouri Sta. Bul. 179 (1921), pp. 30–36*).—Continuing work already noted (E. S. R., 43, p. 735), variety, cultural, and fertilizer tests with various field crops are described.

Biggs Seven-ear led the prolific corn varieties with a 3-year average acre yield of 24.3 bu., while Commercial White was first of the native types, averaging 22.9 bu. In cultural experiments at both Maryville and Warrensburg, the maximum yields were obtained when no normal cultivation was followed, but the surface was scraped clean throughout the growing season. The results indicate low yields from late cultivation and high yields from surface scraping.

In trials of seasonal forage crops at Warrensburg, spring seeded oats and Canada peas, with 3.27 tons per acre, and summer seeded sorghum and soy beans, with 3.38 tons per acre, gave the best results. Sudan grass seeded in 3-ft. rows averaged 2.44 tons of cured hay per acre from a single cutting made October 3, while seeding in 8-in. rows with a grain drill gave but 1.93 tons. When seeded in 3-ft. rows at Columbia in early summer, a total of 4 tons per acre was made in two cuttings up to September 15, and 14.5 bu. of seed up to October 1.

Wheat-breeding investigations comprised studies of hybrid and pure-line selections. Tests of commercial varieties of spring and hard and soft winter wheat showed the superiority of the hard winter Kanred, and the semihard Fulcaster over the soft wheat, Michigan Wonder, and the spring wheats, Scotch Fife and Marquis; the inferiority of Kanred at Warrensburg; and the very marked inferiority of spring wheat at Columbia and Maryville. Mediterranean selection 31 with 32.7 bu., Mediterranean selection 30 with 31.7 bu., and Harvest Queen with 31.6 bu. led in 6-year average yields as compared with 26.1 bu., the average of all varieties, and 24 bu. from the original Mediterranean stock.

Texas Red, with an average acre yield of 35.7 bu., and American Banner, with 35.1 bu., were first of early and late oats varieties, respectively. In nursery tests at Columbia, Irish Victor, Kherson, Sixty-day, and Fulghum led in the order named.

Treatment of soy bean stubble by either harrowing, single or double disking with or without harrowing, or double disking, rolled, failed to show profit over no treatment in preparation of a seed bed for wheat. It is indicated that bean stubble land, spring plowed and kept fairly clean during the season, is without further treatment an excellent seed bed for wheat.

Leading soy bean varieties at Columbia, in seed production, were Tokio with 23.3 bu. and Mikado and Morse with 20.5 bu. Chiquita with 3.3 tons and Columbia with 3 tons of cured hay were first in hay yields. Comparisons of soy beans and cowpeas for hay and seed showed the strong superiority of the soy bean for both purposes. New Era, Red Ripper, and Groit, with 21.8, 21.1, and 20.3 bu. per acre, respectively, were the leading cowpea varieties.

Fertilizer and variety tests with cotton are also noted. Significant differences between average yields of large and small boll varieties were not observed.

Results of cultural experiments with alfalfa and sweet clover at Columbia showed that on average Missouri upland sweet clover invariably outyielded alfalfa, differences in sweet clover being greatest on untreated land and least on land well limed, fertilized, and manured. Sweet clover or alfalfa seeded with a nurse crop gave much lower yields than when seeded alone. Small grain nurse crops seeded with sweet clover gave decidedly lower forage and grain yields than when alfalfa was sown with them, due doubtless to the heavier growth and greater competition of the sweet clover.

Grain sorghums outyielded corn varieties by a wide margin at Warrensburg and Cuba. The average yield of 4 sorghum varieties was 30.1 bu. per acre, while that of 8 corn varieties was but 23.2 bu. Dwarf Milo, with 38.8 bu. of grain per acre, led the sorghum varieties.

[Report of field crops work in North Dakota, 1919–20] (*North Dakota Sta. Bul. 146 (1921), pp. 10–13, 14–20, 35, 36, 37, 38, 41, fig. 1*).—Experiments with field crops including variety and cultural tests of wheat, oats, barley, rye, flax, and potatoes; milling and baking tests with wheat; rotations; seeding trials of sweet clover; and breeding work with alfalfa, smooth brome grass, wheat, and corn, and disease-resistant varieties of wheat, rye, and flax are described in continuation of work already noted (E. S. R., 43, p. 332). Cross-fertilization studies with alfalfa have been noted (E. S. R., 45, p. 36).

The leading varieties as indicated by tests include Marquis, Dakota Bluestem, Kota, and Monad wheat; Kherson and Swedish Crown oats; Manchuria barley; Wisconsin 1219 rye; North Dakota flax selections; and King potatoes.

[Report of field crops work at the Edgeley Substation, 1914–20], O. A. THOMPSON (*North Dakota Sta. Bul. 145 (1921), pp. 9–19, 26–37*).—Variety, cultural, fertilizer, and rotation tests conducted in cooperation with the U. S. Department of Agriculture are reported in continuation of work previously noted (E. S. R., 32, p. 528).

In variety tests with spring wheat during the period 1908–1916, the highest average acre yields produced in each class were for fife 19.5 bu., bluestem 14.4 bu., Preston 15.8 bu., and durum 20.5 bu. The durums outyielded the bluestem varieties 6.2 bu. and the fife 4.7 bu. per acre. Flax varieties averaged from 11.2 to 12.9 bu. per acre during the five-year period 1912–1916. Early, medium, and late ripening varieties of oats made 10-year average yields of 43.3, 48.1 and 41.7 bu. per acre, respectively. Northwestern, Rustler white, and Golden were among the best of the dent corn varieties tried, and Gehu, Dakota white, and Squaw are considered probably the best flint varieties for the region.

Results of trials indicate that the profitable culture of feterita, kaoliang, Sudan grass, and Early Amber cane is doubtful under the climatic conditions. German and Siberian millets yielded more and better hay than hog millet, but the latter led in seed production. Ten-year average yields of forage crops, including brome, alfalfa, red clover, and corn were 2,724, 2,078, 1,160, and 3,960 lbs. per acre. Cultural directions for brome grass, Canada field peas, sweet clover, slender wheat grass, and alfalfa are indicated in brief.

Variety trials with potatoes show Early Ohio and Early Six Weeks best adapted.

Rate of seeding trials indicate that where a continuous cropping method is followed, the highest yields in durum hard wheat and oats are secured from an intermediate to a heavy rate of seeding, and that barley averages best from a light rate of seeding, about 1.5 bu. per acre. Where very thin seeding was practiced, the field was very weedy and occasionally the weeds interfered with harvesting.

In cooperative work in cultivation methods with the U. S. Department of Agriculture during a 14-year period, 1907–1920, summer tillage gave an increased yield over continuous cropping of 1.6 bu. per acre for wheat, 13.6 bu. for oats, and 2.8 bu. for barley, and a decrease of 279 lbs. for corn. Summer tilling land in rotation gave an increase of 2.4 bu. per acre of wheat and 5.9 bu. of oats in comparison with the yields of the same crops after small grain. A comparison of 13 years' average yields of wheat and oats secured after green manure crops and after fallow in the same type of rotation failed to show striking differences, except that where oats followed green manure from 2 to 5.9 bu. less were produced. Wheat immediately following a manured fallow gave 1.8 bu. and oats 1.3 bu. more per acre than where the fallow was not manured. Corn grown the second year after manure was applied generally gave better yields than where the land was unmanured, averaging from 877 to 967 lbs. per acre in favor of the manured rotation. The results indicate that the addition of manure to land intended for corn rather than to the fallow would minimize the tendency of manure to cause a heavy growth of straw in the cereals. An increase of 0.7 bu. of wheat and 4.6 bu. of barley per acre in favor of corn land as compared to summer fallow, and a gain of 4.9 bu. of oats per acre in favor of summer fallow were noted. Although the difference between the two methods is low, the heavy yields of coarse food provided for live stock feeding by corn land would more than offset gains occurring from summer fallowing.

Oats following alfalfa, brome, clover, and wheat and barley made 13-year average acre yields of 25.9, 27.6, 30.3, and 31.8 bu., respectively. Observations made to note the effect of one crop on those which follow show that this effect is mostly due to moisture being reduced by the preceding crop. Wheat, oats, and barley after corn showed gains in yield over the same crops grown continuously or after other small grains in rotation. Wheat after corn, oats, and wheat produced 14-year average acre yields of 17.1, 14.1, and 11.6 bu., respectively; oats following corn, barley, wheat, and oats averaged 34.4, 30.3, 31.9, and 26 bu., respectively; and barley after corn, oats, and barley made respective average acre yields of 24.5, 22.4, and 17 bu.

About equal returns for wheat and oats were given from fall and spring plowing, but higher yields of barley and corn resulted from spring plowing. Fall plowing has a decided advantage over spring plowing for cereal crops, permitting earlier seeding. Disking corn ground produced a gain of 0.7 bu. per acre for wheat and 1.4 bu. for oats over plowing the land.

The use of commercial fertilizers in continuous cropping with wheat, oats, barley, and corn did not produce outstanding results, and it is considered questionable whether the additional profits secured from their use will pay for the cost of fertilizer and application.

[Report of field crops work in Wisconsin, 1919–20] (*Wisconsin Sta. Bul. 323 (1920), pp. 17, 29, 58, 59, 73, 75–92, figs. 14*).—The progress of work conducted in continuation of that noted heretofore (E. S. R., 44, p. 225) is outlined.

Investigations by W. E. Tottingham and S. Lepkovsky regarding changes of nitrogen compounds in the leaves of the sugar beets during the day and night indicate that the greatest manufacture of protein in the leaves closely follows the largest production of carbohydrates. With the coming of moderately cool nights (50° F.) the increase of soluble protein in the leaves was particularly striking.

Analyses of soy bean selections from the seventh year's work in breeding for increased oil content showed a high line strain and a low line strain, with iodin indices of 132 and 124, respectively, indicating the effect of selection. The low line strain was entirely of a dwarf type, while the high line strain consistently produced both tall and dwarf types, pointing to a definite relation between plant height and quality of oil. A high-producing strain as well as a low-producing strain has been isolated.

In trials made by J. G. Milward, in cooperation with the U. S. Department of Agriculture, to determine some of the factors influencing freedom from disease, vigor, and productiveness in five leading varieties of potatoes, differences varying from 5 to 90 per cent of infection with mosaic disease were found in the 17 strains of Triumph studied. The Smith strain showed the least infection, counts ranging from 2 to 10 per cent, and also proved uniformly superior in all comparative trials, in both the North and South.

Australian field cress is described as a new exceedingly noxious weed pest, worse than either quack grass or Canada thistle, and closely resembling yellow marsh cress (*Radicula palustris*) in leaf characters. Cultivation spreads the pest further. Although covering small patches in alfalfa plats with straw to 3 ft. in depth proved useless, a 6 ft. depth of straw held the weed in check. Covering isolated areas with a heavier grade of building tar paper was the more effective treatment.

Work with alfalfa was conducted at Madison by L. F. Graber. Records for the period 1915–1920 show a total yield of Grimm variety from 20.8 to 22.5 tons per acre, while Montana common ranged from 13.1 to 18.7 tons per acre. In a 2-cutting crop, plats 1 and 3 years old made 4.2 and 5.7 tons, respectively. At the time of blossoming the older alfalfa in both cuttings was fully 9 in. taller, and the root system was much larger, deeper, and more widely developed. Results secured by E. J. Delwiche at the Spooner Substation show that the crop can be grown successfully on sandy loam soils, with yields in normal seasons equaling clover. One hundred strains planted in 1916 from seed of resistant plants have not shown indications of winter-killing. Studies of different varieties from various sources have evolved a method of distinguishing genuine Grimm, Baltic, and Cossack varieties from nongenuine varieties during the first season the alfalfa is grown. The genuine hardy varieties undergo a period of fall dormancy which sets in at a comparatively early date, while the common varieties continue to grow in the fall of the year, especially when there is a reasonable amount of rainfall. In controlling weed growth, close cutting gave better results, without seriously injuring the alfalfa, than where as much as 5 in. of alfalfa was left. Where close cutting was practiced, virtually all weed growth was held in check, and with a normal amount of moisture a new, healthy, vigorous alfalfa growth developed. In plats where the alfalfa was clipped long, foxtail grew rapidly and headed out, requiring the cutting of the field again in August to save the alfalfa.

Experiments by G. B. Mortimer indicated that about 20 lbs. of Sudan grass seed per acre gives the best returns, with an average of 3.2 tons of hay. Results of five years' experiments show an average hay yield of 2.5 to 3 tons per acre, which is in excess of the yields of either common or German millet grown under similar conditions. Sudan grass did well with all varieties of soy beans used when drilled at the rate of 10 lbs. with 60 lbs. of soy beans. Yields of cured hay obtained with Wisconsin varieties of soy beans ranged from 2.8 to 3.3 tons per acre. Better results were secured from Sudan grass alone and also Sudan grass with soy beans than from peas and oats for hay. Where peas were used with medium late oats, 2.72 tons of cured hay was produced, as compared with 2.13 tons with an early oats variety.

Variety tests with winter and spring wheat and rye, oats, and barley were conducted by B. D. Leith. The 1920 yield of Wisconsin Pedigree No. 2 winter wheat (Turkey Red) was 46.7 bu., as compared with a 5-year average acre yield of 33.9 bu. During the latter period the yield of spring wheat was about one-half that of winter wheat. In a 3-year test with rye, Wisconsin Pedigree No. 2 averaged 44.5 bu. per acre, while Rosen made 34.9 bu. During this period the yield of spring rye averaged only about half that of winter rye.

In tests of soy-bean varieties conducted by G. M. Briggs, Elton and Early Green proved suitable to Wisconsin conditions, and of the early seed varieties, Mongol was preferable to Mammoth. Planting soy beans in corn failed to effect an increase in yield over planting corn alone, due, perhaps, to interference with cultivation, which permits weed growth.

In trials of sunflowers for silage, E. D. Holden found that the Argentine variety made 8.33 tons of silage per acre, while Giant Russian made from 20 to 25.75 tons. Sunflowers proved more drought resistant than corn, producing larger and heavier crops. Where corn was killed by frost in early September, sunflowers were one-third taller than the corn, of normal green color, and showed no effects of frost. When 10 to 30 per cent of the plants are in bloom is deemed the most favorable time for cutting.

In further comparisons by Leith, when No. 12 Golden Glow corn and the cold-resistant strain were planted on May 1 at the station, but 69.8 per cent of Common No. 12 had emerged on May 19, as compared with the cold resistant as 100 per cent. Where maturity counts were made on August 31, 68 per cent as much common Golden Glow had matured as the cold resistant. H. W. Albertz found that corn gathered two weeks before the regular harvesting time when the kernels were just beginning to dent and containing about 50 per cent moisture, germinated equally as well as or better than that gathered at the regular harvest, if properly cured with artificial heat.

In work with field peas by Delwiche, culture inoculated peas yielded 1,333 lbs., soil inoculated 1,125 lbs., and uninoculated 1,016 lbs. of seed per acre. Tests at the Spooner Substation indicate the possibility of growing peas on the lighter types of soils which are free from excess moisture, thereby lessening the danger from blight and rot.

Work with hemp and fiber flax was conducted by A. H. Wright, of the U. S. Department of Agriculture. During 1920, 6,500 acres of hemp, an increase of 2,000 acres over 1919, were grown in the State. Hemp grown on marsh land made very good growth, the quality of fiber depending on the length of the cultivation of the land and the succession of crops. Fiber obtained from newly broken marsh soils was practically worthless for spinning, but where hemp was grown 2 or 3 years in succession on marsh lands, decided improvement followed. When the crop was grown on soil cultivated with intertilled crops for 5 to 10 years, a very good quality of fiber was produced. The hybrid Ferramington (Minnesota No. 8 × Ferara) matures early enough to produce good seed yields and attains a better height than Italian or other early-maturing sorts, and is being further selected. Although many Japanese strains are good, the possibility of securing from Japan the kind of seed ordered should be determined, as many strains supplied by Japanese dealers are of the so-called bird seed types and valueless for fiber.

Dodgeville and Mazo Amber possessing total solids ranging from 17 to 22 per cent, gave good results in sorghum work.

The improvement of our crops by selection, E. E. Barker (*Porto Rico Dept. Agr. and Labor Sta. Circ. 30* (*1920*), *Spanish ed., pp. 3–24, figs. 2*).—A popular discussion of methods of improvement by selection with sugar cane, yams, yautias, malangas, sweet potatoes, corn, rice, cotton, tobacco, vegetables, fruits, pineapples, coffee, coconuts, and bananas. Forms are included for judging and securing field notes on the various crops considered.

Variety tests of corn, wheat, and soy beans, J. E. Metzger and G. Eppley (*Maryland Sta. Bul. 237* (*1920*), *pp. 23, figs. 10*).—The experiments reported supplement earlier trials of varieties of corn (E. S. R., 33, p. 528), wheat (E. S. R., 37, p. 340), and soy beans (E. S. R., 37, p. 442). See also another note (E. S. R., 43, p. 133).

The leading corn varieties in the period 1915 to 1919, inclusive, included Boone County White, Thomas, Giant Beauty, Golden Gem, and Silver King. Among the first in the 10-year average yields of wheat varieties were Mammoth Red, China, Currell Prolific, Turkish Amber, and Bearded Purple Straw. Of new varieties grown but 3 years, Kharkov and Leap Prolific made good yields, while

Kanred proved very unsatisfactory. Results of tests extending over a long period indicate that Virginia, Wilson, Edna, Cloud, and Haberlandt are the best varieties of soy beans for Maryland. Virginia was highest in seed production throughout the test. Patuxent is considered a valuable soy bean for the Piedmont region.

[Work with rice and cotton in Texas] (*Texas Sta. Rpt. 1919, pp. 10, 11, 14*).—Outstanding results in studies of the effect of environment on the development of the rice plant have shown that surface irrigation water is essential to its maximum development. When applied almost continually throughout the season, the chief effect of surface water is to increase tillering, thus providing for more heads, while influencing only slightly the difference in the size of the heads and kernels.

Inheritance studies with cotton involving widely contrasted characters, such as green and red plant color, white and colored lint, long and short fiber, and upright and spreading plants, are noted. In studies of the inheritance of high and low oil content in cotton seed, plants of the high oil strain of F_0, F_1, F_2, and F_3 generations averaged 19.51, 20.72, 19.97, and 17.32 per cent of oil, respectively, while the seeds from the plants of the low oil strain averaged 16.89, 18.2, 17.88, and 15.54 per cent in the same respective generations.

Profitable root crops, E. J. Delwiche (*Wisconsin Sta. Bul. 330 (1921), pp. 22, figs. 12*).—A popular account of the production and utilization of root crops in Wisconsin. Cultural and field operations employed in growing and harvesting rutabagas, turnips, sugar beets, and mangels, and storage practices are outlined in brief.

Experiences with alfalfa, S. C. Damon (*Rhode Island Sta. Bul. 184 (1921), pp. 26, figs. 4*).—Results of experiments and experiences in growing alfalfa at this station during a period of over 25 years are summarized and information on the culture and harvesting of the crop presented. See also an earlier note (E. S. R., 28, p. 737).

Alfalfa grown for 10 consecutive seasons on one plat averaged over 2.5 tons of hay per acre. Drilling seed proved better than broadcasting. Seeded with oats as a nurse crop, alfalfa made but little growth. Alfalfa seeded early in July yielded practically as much as that sown early in April. Seeding 15 lbs. of alfalfa and 7.5 lbs. of timothy per acre gave an average of 3.8 tons of superior quality hay, of which the first cutting was a good mixture and the second and third almost clear alfalfa. Although the 5-year average acre yield of a mixed seeding of alfalfa and orchard grass was 3.91 tons as compared with 4.5 tons of alfalfa, the mixture dried faster than clear alfalfa and produced a good quality of hay relished by stock. Drilled at the rate of 5 lbs. per acre on a relatively light piece of sloping witch grass sod after a liberal application of lime and floats had been harrowed in, alfalfa gave an average acre yield of 4.4 tons of hay, but the second year about 50 per cent of witch grass was found, and in the third year a still greater percentage. Alfalfa seeded in corn in an attempt to improve a light unproductive soil did not meet with much success (E. S. R., 44, p. 626), nor did that broadcasted on frozen ground make a successful growth.

Results of liming experiments (E. S. R., 32, p. 622; 42, p. 625) show conclusively the value of an adequate application of lime previous to seeding alfalfa. Mixing the lime with the subsoil at the bottom of the furrow before seeding did not increase the alfalfa yield (E. S. R., 35, p. 229). The use of either slacked lime or sodium carbonate as a top-dressing for alfalfa did not increase yields, even though no lime had been added for a number of years previously and the soil was quite acid.

From results on limited areas the use of nitrate of soda in fertilizer for alfalfa was not considered advantageous. So-called American rock potash compared favorably with sulphate of potash when used in a fertilizer for alfalfa (E. S. R., 42, p. 430).

Allowing the first and second crops of alfalfa to obtain their full growth before making the cutting was of decided advantage. The success of alfalfa as a cover crop is held to be dependent on the freedom from alternate freezing and thawing which tend to cause heaving. About 90 per cent of alfalfa roots from the North Dakota Station, planted in 1912, were still alive in 1920. Plants with bluish flowers made more vigorous growth and gave larger yields than those with yellow blossoms. Field transplanting of plants was found to have some advantage.

The regional adaptation of corn in Nebraska, T. A. Kiesselbach and F. D. Keim (*Nebraska Sta. Research Bul. 19* (*1921*), *pp. 64, figs. 13*).—Investigations to determine some of the factors involved in the regional adaptation of corn, by making a comparative study of native corn types known to be locally adapted to various regional areas in Nebraska through long growth, are described. Meteorological and soil data show the widely diversified growing conditions in different regions of the State. Morphological and histological plant characteristics involved in the adaptation of dent corn to various Nebraska environments, together with comparative yield data, are assembled and tabulated by localities into eastern, central, and western Nebraska groups. The material studied comprised native corn types representing 12 different parts of the State, grown in and out of their home environment.

From the relatively favorable conditions of eastern Nebraska to the combined short season, low temperature, and low precipitation of western Nebraska the native corn types assume more and more a dwarfish growth habit. The stalks become shorter and bear the ear closer to the ground. The total leaf area per plant decreases through a reduction in number, length, and width of leaves. The ratio of leaf area to dry plant substance and the proportion of grain to stover remain fairly constant. The ears become shorter, smaller in circumference, fewer rowed, and frequently are scrubby in appearance; and the shelling percentage lowers, and the kernels become shorter and more flinty, as well as slightly lighter in weight. The average measurements of plant characteristics of native corn types grown in eastern Nebraska are given, and, based on these measurements as 100 per cent, the relative values for central and western Nebraska, respectively, are as follows: Height of stalk 8.05 ft., 78 and 68 per cent; height of ear 3.5 ft., 66 and 40 per cent; leaf area 1,222.1 sq. in., 67 and 44 per cent; stover weight 198.6 gm., 74 and 50 per cent; ear weight 231.2 gm., 67 and 39 per cent; total dry matter 429.8 gm., 70 and 44 per cent; grain weight 194.1 gm., 63 and 35 per cent; shelling percentage 83.5, 95, and 89 per cent; leaf area per gram of dry matter 2.89 sq. in., 95 and 98 per cent; ear length 7.36 in., 90 and 79 per cent; ear circumference 6.17 in., 94 and 84 per cent; kernel length 0.485 in., 93 and 84 per cent; kernel width 0.316 in., 103 and 101 per cent; and kernel weight 0.2854 gm., 85 and 61 per cent.

Extensive studies of leaf structure show the leaf and epidermal thicknesses of native types to be fairly constant throughout the State. In the less favored regions, the stomata tend to be somewhat smaller and greater in number per unit leaf area. This stomatal character is associated with a rather corresponding reduction in size of epidermal cell, which the author ascribes to a more dwarfish development. The number of vascular bundles per unit cross section of leaf is fairly constant. While some of the vegetative characters, such as total leaf area and plant weight, may be reduced as much as 300 per cent, no important histological leaf characters exhibit more than 15 per cent deviation in native types growing in the most adverse as compared with the most favored parts of the State. Practically speaking, adaptation with corn consists in a morphological rather than a histological reaction.

The immediate effect of moving corn from its native environment to less favorable conditions, climate being the chief variable factor, was generally a reduction in both vegetative growth and grain production, the stunting growth effect extending to the cell unit, which in turn was accompanied by histological changes apparently not of an adaptive nature. On the contrary, moving corn to conditions more favorable than its native habitat accelerated the vegetative growth and grain production. This stimulating growth effect extended to the cell unit with its accompanying histological changes, likewise not thought to be of an adaptive nature.

To determine the actual hereditary difference between types adapted to favorable and unfavorable climatic conditions, eastern and western Nebraska corn were compared at the station in Lancaster County. The western corn was much smaller in plant size, leaf area, and dry matter. Plants from seed of both sources were rather similar as to leaf thickness, epidermal, and cuticular thickness, relative numbers of vascular bundles, number of stomata per unit leaf area, and size of stomata. While slightly shorter stomatal aperture, accompanied by a slightly smaller epidermal cell, appears to be characteristic of the short season dry land types of western Nebraska, this shortening of stomatal aperture is not effective in checking the transpiration rate per unit leaf area. When Kimball County (western Nebraska) corn and Lancaster County (eastern Nebraska) corn were compared by the potometer method as to their relative transpiration rates, Lancaster County plants were 51 per cent taller, had 88 per cent greater leaf area, and 79 per cent greater dry matter than Kimball County corn, and used 81 per cent more water per plant, 3 per cent less water per unit leaf area, and equal amounts of water per unit dry plant substance produced. In a comparison of two varieties each from western and eastern Nebraska and from New York State the seasonal transpiration per unit leaf area was respectively, 102, 101, and 100 gm., with the corresponding total plant transpiration 85.8, 114.7, and 97.2 kg., respectively. The data are held to indicate that adaptation of corn to a region of moisture shortage consists in the reduction of vegetative development and consequent reduction in the amount of water used by the individual plant.

In a comparative 2-year-yield test at the station of corn types representing 12 distinct regional areas within the State, those from the nearest localities yielded highest. When grouped into eastern, central, and western Nebraska groups, the acre yields were, respectively, 59.8, 46.2, and 31.6 bu., for equal planting rates normal for adapted types in Lancaster County, with corresponding maturity dates—September 24, 21, and 12. When native station Hogue Yellow Dent was compared at the station with varieties from local farmers and from distant eastern Nebraska farmers, the relative grain yields of the three groups were, respectively, 100, 94, and 91. Corn from southeastern counties averaged 56.9 bu. as compared with 63.7 bu. for seed from northeastern counties, and 66.7 bu. for the station Hogue Yellow Dent, with relative group yields of 85, 96, and 100, respectively.

Local station seed yielded 18 per cent more than imported seed from the experiment stations of 8 neighboring States acclimated to conditions prevailing at those stations. From these tests native seed is held generally superior to imported seed. While it is entirely possible to secure seed from other sources which may be substituted for the native home grown seed without detriment, importation from a distance is considered hazardous.

Lines of greatest type similarity run diagonally across the State in a northeasterly and southwesterly direction. Along these lines the more favorable temperature and longer growing season of the southern portion tend to counterbalance the more favorable precipitation of the northern portion in their effects upon the hereditary growth habits of corn. When seed corn is moved far within the State, it is usually safest to move along such lines.

The claim that corn native to dry-land regions possesses a special efficiency in grain production, producing, in contrast to corn native to more humid regions, a relatively large amount of grain in proportion to its vegetative growth was not substantiated by the data obtained.

Fertilizing the corn crop, C. E. Thorne (*Ohio Sta. Mo. Bul. 6* (*1921*), *No. 3–4, pp. 35–37*).—The effects of limestone, acid phosphate, and other fertilizers and manure on yields of corn are described. In 5-year rotation experiments with corn, oats, wheat, clover, and timothy, corn grown on land limed for each corn crop at the rate of 2 tons per acre since 1901, and on land unlimed, produced respective acre yields of 36.4 and 21 bu. in 1920 as compared with 27-year averages of 31.1 and 24.7 bu., respectively.

Treatment with acid phosphate at the rate of 80 lbs. per acre each on corn and oats and 160 lbs. on wheat has increased the average yield of corn for five successive 5-year periods by 3.96, 9.74, 9.78, 7.59, and 6.12 bu. in the average of both limed and unlimed land. In 1920 the increase was but 4.42 bu., apparently indicating the need of something besides acid phosphate alone. Where this dressing of acid phosphate was reinforced with muriate of potash, 80 lbs. each on corn and oats and 100 lbs. on wheat, the 5-year average yields were increased by 7.21, 14.17, 19.42, 17.41, and 19.3 bu. for the 5-year periods, and by 16.95 bu. for 1920.

The addition of 160 lbs. of nitrate of soda per acre for each of the grain crops resulted in 5-year average increases of 10.72, 19.45, 24.04, 20.9, and 21.72 bu., and 18.02 bu. for 1920. So far as the corn crop is concerned the increases have not justified the cost of the nitrate.

Where fresh stable manure reinforced with 40 lbs. of acid phosphate per ton was spread upon the land in winter at the rate of 8 tons per acre and plowed under for corn in a 3-year rotation of corn, wheat, and clover, the average annual corn yield for successive periods of 6 years, or two rotations, has been increased by 25.76, 41.19, 39.1, and 35.87 bu. per acre. The total value of the increase averaged $50.12 for each 3-year rotation, or $16.71 per year, as compared with $10.39 per annum for the most effective chemical fertilizer.

In the average of 14 experiments on different county experiment farms, 160 lbs. of acid phosphate has increased the yield of corn by about 5.5 bu. With the addition of 45 lbs. of muriate of potash to the phosphate the increase has risen to 8.66 bu., and with the further addition of 96 lbs. of nitrate of soda to 9.5 bu. While the addition of potassium would be profitable at normal prices for that element and for corn, there is no encouragement for the use of fertilizer nitrogen for corn on clover sod.

Cotton variety experiments [at] Substation No. 3, Angleton, Tex., E. B. Reynolds (*Texas Sta. Bul. 274* (*1921*), *pp. 5–10*).—Results of trials with cotton varieties conducted at this substation from 1917 to 1920, inclusive, are reported. The leading varieties were Mebane, Kasch, Lone Star, Acala, and Snowflake, with average acre yields of 485, 462, 458, 409, and 304 lbs. of lint, respectively, and 860, 705, 787, 746, and 654 lbs. of seed.

Sea Island cotton in St. Croix, L. Smith (*Virgin Islands Sta. Bul. 1* (*1921*), *pp. 14, pls. 2*).—A résumé of work conducted with Sea Island cotton in St. Croix. The progress of many of the early experiments in improvement by hybridization and seed selection has been noted from other sources (E. S. R., 33, p. 834; 44, p. 332). Cultural and field practices obtaining on the island are outlined, and diseases (E. S. R., 32, p. 642) and insect pests are described and control methods indicated. Plat tests of individual cotton-plant selections, conducted in 1919–20, have been noted from another source (E. S. R., 45, p. 126).

Linters, A. M. Agelasto (*U. S. Dept. Agr., Dept. Circ. 175 (1921), pp. 10*).—This circular describes the character and length of fiber and the production of linters and discusses the marketing and uses of the material. The manufacture of mattresses and explosives from linters is briefly noted in outline. The need of standards and further utilization to facilitate trade and prevent waste of the commodity is indicated.

Spur feterita, A. B. Conner and R. E. Dickson (*Texas Sta. Bul. 275 (1921), pp. 7–28, figs. 14*).—The origin, adaptation, and description of feterita and Spur feterita are presented, together with data on the monthly distribution of precipitation at Spur, Lubbock, and Temple, Tex. Spur feterita originated at the Spur Substation "as a result of selection and head-row planting." The average results of comparative tests with the improved feterita and other sorghums may be summarized as follows:

Data on sorghum growth and yields at Spur (Texas) Substation in 1919.

Crop.	Stalk.		Length of growing season.	Grain per head.	Acre yield.
	Diameter.	Height.			
	Cm.	*Cm.*	*Days.*	*Per cent.*	*Bu.*
Spur feterita	1.88	156	97	76.7	50.1
Unimproved feterita	1.47	188	90	72.6	45.6
Milo	1.60	108	94	76.4	33.1
Kafir	1.85	111	115	74.3	29.2

Fertilizing the oats crop, C. E. Thorne (*Ohio Sta. Mo. Bul., 6 (1921), No. 3–4, pp. 38, 39*).—Experiments on the effect on the oats crop of liming, acid phosphate, residual effect of manure, and fertilizers carrying phosphorus and potassium only are described.

In a five-year rotation experiment, including corn, oats, wheat, clover, and timothy, oats grown on land limed for each corn crop since 1905 at the rate of 2 tons per acre of finely ground raw limestone, and on unlimed land, produced 49.2 and 27.4 bu. in 1920, as compared with an average of 35.7 and 29.5 for the period since liming began. On part of the land which received acid phosphate at the rate of 80 lbs. per acre each on corn and oats and 160 lbs. on wheat, or a total of 320 lbs. for each five-year period, the yield of oats in 1920 was 53.75 bu. on the limed half and 42.5 bu. on the unlimed half, indicating that the phosphate had partly made up for the lack of lime. Where the acid phosphate was reinforced with muriate of potash at the rate of 80 lbs. each on corn and oats and 100 lbs. on wheat, the 1920 yields were 63.44 bu. on the limed half and 44.22 on the unlimed half. Where 160 lbs. of nitrate of soda on each of the three grain crops was added to the above dressing the yield was 63.28 and 57.5 bu. on the limed and unlimed sections, respectively. Liming apparently made the use of nitrogenous fertilizers unnecessary by encouraging a larger growth of clover.

On land receiving barnyard manure on corn and wheat at the rate of 8 tons per acre on each crop, the oats receiving no treatment, the yield of oats was 56.56 bu. on the limed land and 54.06 on the unlimed land.

Oats variety test at Ohio State University, J. B. Park (*Ohio Sta. Mo. Bul., 6 (1921), No. 3–4, pp. 63, 64*).—The leading oat varieties at the University Farm at Columbus were Fulghum, Big Four, Ohio 6203, and Sixty-Day, with three-year average acre yields of 67.6, 65, 63.4, and 61.8 bu., respectively.

Investigations with seed potatoes [in Missouri], J. T. Rosa, jr. (*Missouri Sta. Bul. 179 (1921), p. 40*).—Findings in seed-storage tests indicated that potatoes intended for spring planting can be kept over winter satisfactorily in cold storage at 32 to 40° F., and in cool outdoor cellars.

Potato production in the South, W. Stuart (*U. S. Dept. Agr., Farmers' Bul. 1205 (1921), pp. 39, figs. 22*).—In this publication, potato production is considered under three seasonal divisions: The early or truck crop; the late or main crop; and the fall crops, comprising the fall crop proper (late maturing varieties grown for table use), and the second crop (early varieties planted for the purpose of growing seed stock for the early crop of the coming year). The crop areas, soils, fertilizers, cultural and field practices, seed, prevention of diseases and insect pests, marketing, and storage are discussed separately for the three seasonal crop divisions.

The leading varieties used for early-crop production include Irish Cobbler, Triumph, and Spaulding No. 4; for the late or main crop, Green Mountain, Gold Coin, Rural New Yorker No. 2, Carman No. 3, Sir Walter Raleigh, White Star, and Early Ohio; and for a fall crop, usually for table use, McCormick, White McCormick, Jersey Red, Green Mountain, Rural New Yorker No. 2, Russet Rural, White Star, and Peerless.

Rooting stems in timothy, R. A. Oakley and M. W. Evans (*Jour. Agr. Research [U. S.], 21 (1921), No. 3, pp. 173–178, pls. 2*).—In investigations at the timothy breeding station, conducted cooperatively at Elyria, Ohio, by the U. S. Department of Agriculture and the Ohio Experiment Station, the authors found two quite distinct types of underground rooting stems in timothy. One type develops when the shoot producing the new plant is covered with soil early in its growth. Some of the unelongated internodes connecting the shoot with the parent plant lengthen, thereby pushing the shoot to the surface of the soil, and roots grow from the nodes between the elongated internodes. A second type of underground rooting stem is produced when timothy plants with growing culms are covered with soil. Buds that sometimes form on the culms of these plants often develop into shoots and ultimately into independent plants, and the culms become underground rooting stems.

Many of the scattering timothy plants appearing in a field where a timothy sod has been plowed under are produced vegetatively from buried stubbles or culms. Rooting stems developing above ground in timothy are not common in this country. Regarding them as a varietal characteristic is considered a very doubtful practice, as apparently they are formed most commonly when weak or decumbent stems come in contact with the soil.

The terms, determinate and indeterminate rhizomes and stolons, are suggested to indicate the types of rooting stems found, especially in grasses.

Yam culture in Porto Rico, C. F. Kinman (*Porto Rico Sta. Bul. 27 (1921), pp. 22, pls. 6*).—Field practices and cultural methods employed in growing the yam (*Dioscorea* spp.) in Porto Rico are described, and the results of fertilizer, cultural, and vine-pruning tests reported. Descriptions of the Guinea, Potato, Tongo, Purple Ceylon, *D. sativa*, *D. chondrocarpa*, *D. cayennensis*, Agua, and Mapuey Morado varieties and cultural treatment applicable to each are included.

Results of fertilizer tests indicated that no one element can be considered the limiting factor in production, and that complete mixtures should be used where fertilizers are applied. The application of 10 tons of stable manure per acre produced an increase of nearly 10 per cent over untreated or chemically fertilized plats, while the plat receiving 20 tons of manure returned less than the untreated check.

Yields from the plants pruned were considerably less than from those unpruned, indicating that for best results the vines should not be pruned or injured. Vines not provided with supports made very poor growth and low yields of roots.

In size-of-seed, cultural, and spacing tests with the Potato variety, large seed roots gave heavier yields than small roots; the average weight per hill of the produce from small seed was but 65 per cent of that from large seed; and roots produced from large seed roots were considerably larger than those from small seed roots. The yield per hill from small tubers planted in ridges was noticeably heavier than from level plantings. Large roots yielded about the same per hill whether ridged or level. Results of spacing tests suggest 3 by 3 ft. as the most economical planting distance.

Yam culture [in the Philippines], F. G. GALANG (*Philippine Bur. Agr. Circ. 115 (1920), pp. 9, pls. 3; also in Philippine Agr. Rev., 13 (1920), No. 1, pp. 63–72, pls. 3*).—Information is given on the culture of yams in the Philippine Islands, together with results of variety tests, cost of production studies, and comparisons of poling methods.

Seed testing [in Idaho] (*Idaho Sta. Bul. 122 (1921), pp. 47–51*).—A total of 2,769 samples of field seeds were tested for purity and 278 for germination during the period December 1, 1918, to December 1, 1920. Seed sold at auction sales is said to have frequently contained seeds of many of the most noxious weeds.

HORTICULTURE.

[Report on horticultural activities for 1920] (*Idaho Sta. Bul. 122 (1921), pp. 39, 40, 41*).—In a study of truck-crop seed production, satisfactory yields were obtained, as shown by a tabulated comparison of station and United States average yields.

Pollination studies with the sweet cherry indicate that the Bing, Lambert, and Royal Ann varieties are not only self-sterile but also intersterile. Black Tartarian was found to be one of the best pollinizers.

Some conclusions from an unpublished report on apple breeding are included.

Report of the [division of horticulture], H. J. EUSTACE (*Michigan Sta. Rpt. 1919, pp. 278–282*).—Apple-dusting experiments at Morrice, Belding, Muir, and Grand Ledge (E. S. R., 39, p. 349) were continued in an effort to ascertain the value of dusts as compared with sprays. At Morrice dusting gave slightly better scab control on apples than spraying. At Muir dusting has been uniformly successful during the past three seasons, but some foliage injury resulted from the combination of lime sulphur and lead arsenate and severe injury from a combination of lime sulphur and calcium arsenate. At Belding the sprayed trees yielded 6 per cent more scabby fruits than dusted trees. At Grand Ledge calcium arsenate in combination with lime sulphur proved equally as efficient as lead arsenate and lime sulphur for control of the codling moth worm and other insects, but in most of the tests the calcium arsenate caused more or less foliage injury.

[Report on] horticulture (*North Dakota Sta. Bul. 146 (1921), pp. 40, 41*).—Variety testing of fruits and vegetables was the principal feature of the horticultural activities for 1919. Of the vegetables, Blue Bantam pea, Crimson Giant radish, Golden Giant sweet corn, Copenhagen cabbage, and Earliest and Sweetest watermelon gave satisfactory results. Selection work with the Earliana tomato was continued and seed of three selections disseminated for trial.

In hardiness studies with fruits, the Hibernal apple was least injured during the winter of 1919–20. Three red raspberry varieties, the Sunbeam, Ohta, and Latham, survived the winter without protection. Of these, the Latham was by far the heaviest yielder.

[Report of] the division of horticulture, O. M. Morris (*Washington Sta. Bul. 158 (1920), pp. 26, 27, 28–30*).—Brief records are made of the progress of various projects (E. S. R., 43, p. 743).

In Mendelian studies with small fruits, only a few successful crosses were obtained between the loganberry and the dewberry, indicating a condition of practical intersterility. In raspberry-loganberry crosses no viable seed was obtained. Black raspberries crossed readily with the red, producing a satisfactory amount of seed. Blackberry-raspberry crosses were unsuccessful.

Orchard cover-crop investigations indicate that hairy vetch is one of the best legumes to use when first establishing the cover-crop system. After vetch has been grown for two or three years, the orchard may be planted to alfalfa. In renovation studies with old prune trees, it was found that such trees may be often stimulated into production of new and vigorous growth by heavy pruning, after the soil has been improved in condition and fertility.

Improved variety No. 9 of native chili, F. Garcia (*New Mexico Sta. Bul. 124 (1921), pp. 16, figs. 7*).—In selection studies with chili (*Capsicum annuum*), one desirable strain known as No. 9 has been isolated. This strain is described as very vigorous, quite prolific, more resistant to chili wilt than the native chili, and as having less pungent fruits than most of the improved varieties.

Cooperative tomato investigation, J. T. Rosa, jr. (*Missouri Sta. Bul. 179 (1921), pp. 41–43, fig. 1*).—Tomato investigations were continued (E. S. R., 43, p. 742). "In 10 series of cooperative tests in 1919, yields of tomatoes were increased on the average 159.2 per cent by 8 tons of stable manure; 152.9 per cent by 250 lbs. of 4:8:5 fertilizer; 152 per cent by 250 lbs. of 4:8:0 fertilizer; and 106 per cent by 250 lbs. of acid phosphate. The most economical gain for the cannery tomato crop was produced by acid phosphate. Another important result demonstrated in the fertilizer tests was the increased earliness of the crop when commercial fertilizer was used. Plats receiving complete fertilizer came into heavy bearing three to four weeks before the unfertilized plats, and plats receiving acid phosphate were two to three weeks earlier than the unfertilized plats."

The fruit industry in California, R. Videla (*La Industria Fruticola en California. Buenos Aires: Wiebeck, Turtl & Co., 1920, pp. 182+[2], pls. 53, figs. 51*).—A discussion of the California fruit-growing industry in all its phases—production, drying, preserving, shipping, marketing, etc.

[Pomological investigations at the Edgeley Substation], O. A. Thompson (*North Dakota Sta. Bul. 145 (1921), pp. 43, 44*).—Hardiness studies with apple, plum, cherry, currant, gooseberry, and strawberry varieties are reported.

[Pomological investigations] (*Wisconsin Sta. Bul. 323 (1920), pp. 56, 59, fig. 1*).—Sterility investigations by R. H. Roberts in Door County showed that Richmond and Montmorency cherries were strongly self-fertile in 1920. Tests indicated that the Burbank plum is self-sterile. Wealthy and McIntosh apples proved to be self-sterile but highly interfertile.

The Salome apple has shown merit as a commercial variety for southern, eastern, and western bluff sections of Wisconsin.

The relation of carbohydrates and nitrogen to the behavior of apple spurs, E. M. Harvey and A. E. Murneek (*Oregon Sta. Bul. 176 (1921), pp. 47, figs. 12*).—This is a report, in the form of two papers, covering two phases of a series of fruit-spur studies being conducted at the station on the relation of nutritional changes in fruit trees to behavior and cultural practices. The investigations are based upon the theory advanced by Kraus and Kraybill (E. S. R., 40, p. 40) that growth and reproduction depend to a considerable extent on the relative proportions of available carbohydrates and nitrogen. A careful review of the literature is presented.

I. *Effect of spur defoliation on the formation of fruit buds*, E. M. Harvey (pp. 16–31).—This paper discusses the results of a study, the aim of which was to determine to what extent the leaves of the individual apple spur control its metabolism, as reflected in the relations of carbohydrates and nitrogen and the formation of fruit buds. Seven-year-old trees of the Wagener, Grimes, and Jonathan were the source of spurs used in the study.

"A total of about 7,000 spurs were taken for analysis, and these were procured from 10 trees of each variety, and proportioned among the varieties as follows: 1,500 Grimes, 2,500 Wagener, and 3,000 Jonathan. Each tree furnished 150 to 300 spurs, depending upon the variety. One-half of the total number of spurs were de-foliated and de-fruited, and the other half de-fruited as checks. The date of defoliation and defruiting was June 12–16, 1919. To avoid mechanical injury to the spur, the two operations were performed with scissors, the petioles and pedicels being cut at a little distance away from the spur. . . .

"Defoliation strongly hindered fruit-bud formation, as shown by the fact that Jonathan, Grimes, and Wagener spurs were able to produce only 38.7, 54.6, and 58.6 per cent, respectively, as many fruit buds as the untreated spurs. Defoliation tended to make the spurs, especially the Grimes, more vegetative, as evidenced by the frequent putting out of short growth and new leaves. Defoliation modified the chemical composition of spurs so that they contained, as compared with the checks: (1) More water and less soluble solids (?), insoluble solids, and total solids; (2) more nitrate nitrogen, total soluble nitrogen, and insoluble nitrogen; (3) more reducing sugars, total sugars (?), and less of hydrolyzable polysaccharids and total carbohydrates; and (4) smaller values of the carbohydrate-nitrogen ratio. The carbohydrate-nitrogen ratio, if given a general interpretation, might be classified along with other important controlling factors of plant development, but a strict mathematical inerpretation is not justified from the present study.

"The effects of defoliation on spurs suggest a high degree of 'individuality,' or dependence of the spur on its own leaves for normal activity. In respect to the degree of 'individuality' shown, the three varieties assume the following decreasing order: Jonathan, Grimes, and Wagener. A general explanation for this relative behavior is suggested. It is pointed out that the idea of the 'individuality' of spurs might possibly be overemphasized, since defoliated spurs were able to carry on about 50 per cent or more of their normal fruit-bud formation."

II. *Effects of spur defoliation on the setting of fruit*, A. E. Murneek (pp. 32–43).—This paper presents a study, the object of which was to ascertain to what extent unfolding leaves of the individual apple spur influence the setting and development of fruit on the spur. A total of 9,600 spurs were used as material, an average of 320 spurs per tree from 10 trees each of Jonathan, Grimes, and Wagener apple varieties. Five spur conditions were studied, complete defoliation, all but one leaf removed, all but two leaves removed, no leaves removed, and no leaves removed but deflorated.

A study of the statistical and chemical data, presented in graphical and tabular form, emphasizes the fact that the setting of fruit in the apple is determined, in large measure, by the amount of foliage on the spur. The percentage of fruit was directly in accordance with amount of defoliation; however, in some instances fruit set on completely defoliated spurs, showing that despite the marked individuality of the spur it obtained food from the tree as a whole. Grimes spurs were able, under complete defoliation, to set more fruit than either Wagener or Jonathan. Defloration without defoliation uniformly increased the leaf area of the spur.

As a result of defoliation, the chemical composition of spurs was altered in the following ways: (1) Total solids decreased, though evidently not in exact proportion to the amount of treatment; (2) no apparent effect was noted in total amounts of soluble sugars, including both reducing sugars and sucrose; (3) hydrolyzable polysaccharids increased with reduction of leaf area; (4) total nitrogen decreased in proportion to defoliation, and a fair correlation was established between leaf area and total nitrogen. Defoliation caused a rather consistent increase in the carbohydrate-nitrogen ratio. The possible cause and value of this change in the ratio is discussed.

Factors influencing fruit-bud development and fruit setting, E. J. KRAUS (*Ohio State Hort. Soc. Ann. Rpt. 53 (1920), pp. 32–39, fig. 1*).—A paper discussing the application of the author's carbohydrate-nitrogen theory (E. S. R., 40, p. 40) to actual orchard practices, pruning, cultivation, planting of cover crops, and fertilization.

When is pruning profitable? E. J. KRAUS (*Ohio State Hort. Soc. Ann. Rpt. 53 (1920), pp. 51–55*).—A paper discussing the principles of pruning, with emphasis on the bearing of the carbohydrate-nitrogen theory on the science of pruning. The necessity of adapting the style of pruning to the material at hand is pointed out, and suggestions are given for handling filler trees, permanent trees, and those needing renovation. A method of summer pruning is outlined which the author asserts has been successful in promoting earlier bearing.

Off-year apple bearing, R. H. ROBERTS (*Minn. Hort., 49 (1921), No. 4, pp. 102–106, figs. 2*).—A discussion of the factors influencing annual and biennial bearing in the apple, based on a previously noted bulletin by the same author (E. S. R., 44, p. 41).

Ten-year yield record of apples, C. W. ELLENWOOD (*Ohio Sta. Mo. Bul., 6 (1921), No. 3–4, pp. 40–45, fig. 1*).—A tabulation of phenological and yield data collected during the period 1910–1919 on 93 apple varieties fruiting in the station orchard.

Apple-orchard fertilization, F. H. BALLOU (*Ohio State Hort. Soc. Ann. Rpt. 53 (1920), pp. 13–16*).—A paper discussing the principles of orchard fertilization as applicable to the poor upland soils of southern Ohio, and presenting a summary of the results of the Ohio Experiment Station projects along these lines. A bulletin upon these by the author and Lewis has been previously noted (E. S. R., 43, p. 647.)

[Memorial to the Rome Beauty apple] (*Ohio State Hort. Soc. Ann. Rpt. 53 (1920), pp. 4–8, fig. 1*).—An important feature of the summer meeting of the Ohio State Horticultural Society, held at Proctorville, Ohio, July 23, 1919, was the dedication of a memorial to the Rome Beauty apple. Information concerning the origin and early history of the variety is presented.

Bush fruits, J. OSKAMP (*Missouri Fruit Sta. Circ. 19 (1921), pp. 12, figs. 9*).—Practical information is given on the culture, pruning, propagation, diseases and insect pests, and varieties of raspberries, blackberries, gooseberries, and currants.

The cultivation of citrus fruits in Porto Rico, F. S. EARLE (*Porto Rico Dept. Agr. and Labor Sta. Circ. 28 (1920), pp. 3–20*).—A circular of practical information for the citrus grower of Porto Rico, discussing location, planting, stocks, varieties, cultivation and management, diseases, insect pests, and marketing.

Citrus culture in China, H. A. Lee (*Calif. Univ. Jour. Agr., 7 (1921), No. 5, pp. 3–6, figs. 3*).—A popular article presenting the author's observations on the citrus-growing industry in the Canton Delta of China, with special reference to varieties and cultural practices.

Experiments on manuring of coconuts at Long Island and general observations on manuring in Seychelles, P. R. Dupont (*Seychelles Ann. Rpt. Agr. and Crown Lands, 1919, pp. 5, 6*).—A tabulation of three years' yield records from plats receiving various manurial treatments indicates the value of potash in increasing the yield of coconuts.

The culture of medicinal plants, H. Zörnig (*Der Anbau von Arzneipflanzen. Munich: Franz Josef Völler, 1920, pp. 112*).—A general discussion of the medicinal plant industry of Germany with special reference to cultivated species, and including a list of wild medicinal herbs and a harvest calendar. The status of medicinal plant culture in many nations is reviewed, and it is pointed out that Germany has in the past produced but a small part of her requirements. The need of remedying this situation is emphasized. Cultural requirements, selection of species, curing, possible occupation for wounded men, and returns are discussed, and cultural and descriptive notes for 52 species included. Numerous references to the literature are cited.

Nantucket wild flowers, A. O. Albertson (*New York and London: G. P. Putnam's Sons, 1921, pp. XLV+442, pls. 8, figs. 100*).—A small illustrated manual of the wild flora of Nantucket, systematically arranged by botanical families and species. A key showing the main characteristics of the families is included.

FORESTRY.

[Reports of the] division of lands and forests (*N. Y. State Conserv. Comn. Ann. Rpts., 9 (1919), pp. 85–174, figs. 41; 10 (1920), pp. 127–199, figs. 33*).—Reports for the calendar years 1919 and 1920 relative to the activities of the New York State division of lands and forests are given, including information relative to the forest preserve and its development from a recreational viewpoint, forest fire protection, reforestation, forest nurseries, control of white pine blister rust, State-wide forestry activities, fire losses, additions to the forest area, and the sale of forest products.

Reports of the Minister of Lands, Forests, and Mines of the Province of Ontario for the [three] years ending October 31, 1919, G. H. Ferguson (*Min. Lands, Forests, and Mines, Ontario Rpts., 1917, pp. XV+158, figs. 28; 1918, pp. [4]+166, figs. 37; 1919, pp. 228, figs. 39*).—Brief accounts are given of the activities of the Forestry Branch for the three years ended October 31, 1919, including forest protection, reforestation, and forest pathology. The report for 1919 contains a preliminary account of a survey of timber tree diseases of Ontario, especially those occurring in the Timagami Forest Reserve. Besides discovering many diseases not known to occur in Ontario, two new forms were found.

Annual progress report on forest administration in the Province of Bihar and Orissa for the year 1919–20, D. O. Witt (*Bihar and Orissa Forest Admin., Ann. Rpt., 1919–20, pp. II+[62]*).—The usual annual administrative report (E. S. R., 44, p. 641).

Forest firewardens' manual (*Trenton, N. J.: Dept. Conserv. and Development, 1920, pp. 40*).—A small handbook of forest fire regulations and laws prepared for the use of fire wardens of New Jersey and other interested parties.

Forest investigations, O. A. Thompson (*North Dakota Sta. Bul. 145 (1921), pp. 39–43*).—A test of forest, shade, and ornamental trees and shrubs at the

Edgeley Substation is reported, and notes are given of those species which have proved satisfactory. Instructions are presented for the establishment of windbreaks with attention to selection of plant materials, planting, and care of the young trees. A comparative study of northern *v.* southern grown nursery stock strongly indicated the superior value of the former.

Forest planting in Ohio, E. SECREST (*Ohio Sta. Mo. Bul., 6 (1921), No 3-4, pp. 51-58*).—A brief article emphasizing the advisability of utilizing the idle and waste lands of Ohio for forestry purposes. The author points out the necessity of selecting species suited to conditions and not simply using personal preferences. Mixed plantings are discussed but, as a general practice, it is advised to plant trees of a single species. The more important hardwood, post-timber, and coniferous species are described, and their special soil requirements noted. Mention is made of several undesirable species.

West Virginia trees, A. B. BROOKS (*West Virginia Sta. Bul. 175 (1920), pp. 242, figs. 116*).—A manual of the trees of West Virginia, in which 101 native species are described and their leaves and fruits accurately delineated. A key to the genera, based on leaves and fruit, is presented. Drawings of 14 important introduced species are included, together with a list of native shrubs and shrubby vines.

Diameter growth in box elder and blue spruce, C. F. KORSTIAN (*Bot. Gaz. 71 (1921), No. 6, pp. 454-461, figs. 3*).—A report of a study of the date and rate of increase in the trunk diameter of the box elder and blue spruce, conducted in Utah in 1920 with the aid of the MacDougal dendrograph. Diagrams are shown illustrating graphically the daily change in diameter of the trunks of both species.

"No direct correlation between the march of diameter growth and current temperatures was found. A careful study of the graphs leads to the inference that the growth response lags behind the temperature, a marked drop in the temperature causing a decrease in or even a cessation of growth. . . . The most interesting fundamental principle of growth exhibited by the records obtained from the box elder and the blue spruce trees is that growth evidently does not begin in deciduous hardwood trees and in evergreen conifers at the same time. . . . It can be seen, therefore, that a determination of the beginning and ending of the period of actual growth will suggest the time during which peeling can be accomplished most easily."

The walnut, F. LESOURD (*Le Noyer. Paris: Libr. Agr. Maison Rustique, 1920, pp. 186, figs. 52*).—A small manual on the Persian walnut (*Juglans regia*), with attention to its botany, varieties, cultural operations, harvesting and handling the nuts and various by-products, insect and fungus pests, etc.

DISEASES OF PLANTS.

Colorado plant diseases, J. G. LEACH (*Colorado Sta. Bul. 259 (1921), pp. 96, pls. 3, figs. 76*).—This is a popular description of the nature of plant diseases and the agencies which produce them, and accounts are given of a number of the specific diseases occurring on Colorado crop plants. In addition, the general principles of plant-disease control and formulae for the preparation and application of standard fungicides for seed treatment are described.

Plant pathology (*Idaho Sta. Bul. 122 (1921), pp. 41-44*).—Brief reports are given of investigations on the relation of soil-moisture content to bunt infection in wheat, calico and russet dwarf disease of potatoes, seed treatment for the control of Rhizoctonia, western yellow tomato blight, and oat smut control. Experiments on bunt infection in wheat showed that the higher the percentage of moisture in the soil, the greater will be the development of smut in the resulting crop. The effect of soil temperatures is also being investigated, and it has been found possible to secure some infection at a temperature of 27° C. (80.6° F.), which is higher than the maximum previously reported for the germination of the spores of this organism.

Some preliminary work on the calico and russet dwarf of potatoes was carried on in 1919 and 1920, and both diseases were found quite prevalent in the southern part of the State. Both diseases have been found to be transmitted by means of the seed tubers. Preliminary trials in the greenhouse are believed to indicate that the diseased tops of plants infected with russet dwarf do not carry the disease to succeeding crops. The symptoms of russet dwarf are considered to indicate that the disease may be a bacterial infection.

Tests were made of fungicides as a treatment of seed potatoes for the control of Rhizoctonia, mercuric chlorid and hot formaldehyde being tested. Neither of the treatments as applied proved to be of special value for the control of the disease, and the yield was considerably reduced where hot formaldehyde was employed. Mercuric cyanid was tested in comparison with mercuric chlorid, but the results were not satisfactory.

In studies of the western yellow tomato blight a species of Fusarium was constantly isolated from the roots of diseased plants, and it has been shown that experiments with this organism may cause a serious damping-off of seedlings in the greenhouse, and also cause serious injury to the root systems of mature plants. Several varieties of tomatoes, which were selected for resistance to the eastern type of Fusarium wilt, were grown to determine their resistance to the western disease, but none were as resistant as the varieties commonly grown in the locality.

For the control of oat smut, the use of 10 parts of water to 1 part of formaldehyde is recommended, perfect control having been secured by this modified method of treatment.

[Investigations on plant diseases], G. H. Coons (*Michigan Sta. Rpt. 1919, pp. 259–264*).—The author gives a preliminary report on a study of means for the identification and classification of some of the fungi imperfecti. About 50 cultures of organisms of the Sphaeropsidales have been maintained in cultures, and certain peculiarities of growth have been noted which it is thought will be of value in their diagnosis. He is also testing some of them by means of biological preparations injected into experimental animals. It has already been found that guinea pigs sensitized with *Fusarium conglutinans* will not respond to *F. conglutinans callistephi.*

Further work with the treatment of potato tubers for the control of scab, black scurf, blackleg, etc., has confirmed the previous conclusions (E. S. R., 41, p. 654) that the time for soaking the tubers in formalin or corrosive sublimate solutions may be very materially reduced. Experiments are briefly reported on the use of mercuric cyanid 1:1000 as a substitute for corrosive sublimate. The solution proved efficient for the treatment of tubers and has the decided advantage of being quite soluble and not corrosive to metals.

An account is given of work on the disease of celery to which the name celery stunt is applied. This disease is quite prevalent, occurring in every muck area of the State. The variety Golden Self-blanching is chiefly affected, and it is believed that this plant will soon become exceedingly scarce on the market. The cause of the disease does not appear to have been determined. Some additional studies have been made of the root rot of celery due to *Phoma apiicola,* the causal organism having been grown in pure culture, its physiological relations determined, and the details of methods of infection ascertained. Three strains of the organism have been recognized which differ greatly in virulence.

Some additional information is given regarding the use of formaldehyde for the treatment of grain for the prevention of disease. It has been found that formaldehyde as applied to grain by the wet method polymerizes readily, and that it has a remarkable affinity for water and can not be driven out of water by boiling.

Some investigations on bean mosaic have confirmed the statements that the disease is carried by the seed. Observations made by the author showed that the most pronounced mottling occurred on the new leaves and on the parts of the leaf nearest the veins, indicating possibly that the virus of disease is transferred through the vascular system. Attention is called to the fact that the variety of bean Robust developed at the station is quite resistant to mosaic.

[Report of the] department of botany and plant pathology (*North Dakota Sta. Bul. 146 (1921), pp. 34, 35, 37, 38*).—It is reported that a number of different strains of Fusaria causing wheat scab have been obtained and that studies on the determination of the biologic specialization of the organisms are in progress. Histological studies have shown that the wheat scab fungus penetrates the endosperms as well as the embryo of the wheat seed. All the common varieties of wheat tested seemed to be attacked by wheat scab organisms, although some varieties showed greater resistance to wheat scab than others. Observations on Helminthosporium showed that the disease varies in intensity on different varieties of wheat, and that blade infections are less severe on wheat than on barley.

Some work on disease control was reported, and for wheat scab the necessity of rotation and the careful selection of corn for planting purposes is pointed out. Particular attention should be paid to corn as this plant is thought to be subject to attack by the wheat Fusarium. Notes are given on diseases of potatoes, particularly Rhizoctonia scab and Fusarium wilt, with suggestions for their control.

Division of plant pathology, F. D. HEALD (*Washington Sta. Bul. 158 (1920), pp. 30–32*).—The author reports a continuation of studies on the relation of spore load of individual wheat grains to the percentage of smut in the subsequent crop. Varying quantities of smut were applied to grains up to 12,000 spores per grain, but the maximum percentage of smut observed was 5.49, while a considerable number of plantings remained entirely free from the disease.

Considerable difference in susceptibility of varieties was observed. Marquis, which carried as high as 842 spores per grain, produced only a single sample of smut, while other varieties showed a higher percentage of smut, indicating greater need of seed treatment. Final tests of 116 varieties of winter wheat for comparative resistance to smut were made and none were found to be entirely smut free, but the strains of Turkey Red continued to show the least smut.

Weekly plantings of heavily smutted seed from August 1 to November 21 showed a maximum occurrence of smut when sown on October 3. Clean treated seed on summer fallow planted at weekly intervals for the same period showed no smut until the plantings of September 12, when 4.5 per cent was observed, increasing to a maximum of 20.64 per cent on September 26. Plantings from October 24 to November 21 were entirely without smut.

A brief report is made on seed treatments for the prevention of smut, copper sulphate and copper sulphate salt formulas giving clean crops. Low concentrations of formaldehyde produced crops entirely free from smut. In treating seed with formaldehyde the author found that seed injury varied with different lots of seeds, showing the importance of preliminary tests of germination, and that formaldehyde injury could be greatly reduced by the limewater bath following treatment.

A plant disease survey is reported upon and a number of diseases added to the list already known to occur in Washington. Some special investigations were carried on with two of the new troubles, skin spot of the potato, due to *Oospora pustulans*, and the moldy core of Stayman Winesap apples. A number of different fungi were found in the core cavities, but only two species, Penicillium and Alternaria, were proved capable of causing a rot which advances outwardly into the pulp.

[Investigations in plant pathology] (*Wisconsin Sta. Bul. 323 (1920), pp. 59–73, figs. 7*).—The investigations of tobacco diseases have been continued by J. Johnson. It is reported that the wilt disease of tobacco, first observed in Maryland (E. S. R., 42, p. 247), is known to occur in Wisconsin, but that varieties differ markedly in their resistance to the disease, the Wisconsin types being about 99 per cent resistant as compared with 32 per cent resistance for White Burley. The brown root rot of tobacco is being studied, but the author was unable to discover any causal organism, although from the appearance of the disease it is evidently due to a parasite. The name brown rot is given this disease because the decayed roots are distinctly brown as contrasted with the black root rot due to *Thielavia basicola*. Various legume plants, potatoes, tomatoes, etc., are attacked by this disease, but they are less susceptible than tobacco. So far no resistant varieties of plants have been found, although there is some indication of a less degree of susceptibility on the part of some varieties.

Continued observations are being made at the station on cabbage yellows, and L. R. Jones and assistants have found that the yellows fungus does not develop in cabbage when the soil temperatures are below 61° or above 93° F. The best temperature for the development of the fungus was found to range from 77° to 84° F., which is somewhat above the optimum temperature for the growth of the plant. It has been found that the strains of cabbage resistant to the yellows may in the early stages prove susceptible to the attack of the fungus, but with increasing age the resistant character is intensified. The relation of the development of yellows in cabbage seedlings to variations in soil moisture has been studied, and it was found that the degree of moisture most favorable to the development of the host plant was also most favorable for the growth of the fungus. According to the report, a standard winter variety and two kraut varieties of cabbage developed by the station are now in commercial use. Attention is called to black rot of cabbage, which is sometimes mistaken for cabbage yellows. This disease is said to be commonly carried by seed and first shows as blackened threads on the seed leaves in the seed bed. Hot weather holds the disease in check, but it may become destructive early in the fall. The disease is caused by bacteria occurring on infected seed, and it is recommended that all seed be treated with a solution of corrosive sublimate, 1:1,000, before planting, and after treating with the fungicide from 20 to 30 minutes that it be dried and planted at once.

Further investigations by G. W. Keitt have shown the perfect control of the cherry leaf spot by spraying with Bordeaux mixture and lime sulphur immediately after the petals fall, the application to be repeated after an interval of two weeks. Bordeaux mixture gives a somewhat better control than lime sulphur, but it causes some leaf injury and defoliation. For the control of apple scab, experiments are in progress which indicate that leaves vary greatly in their susceptibility to the attack of the fungus at different stages in their development. The foliage of different varieties also shows a difference in response to the attacks of the fungus. Spraying experiments have shown in general that lime sulphur gives satisfactory results, while Bordeaux mixture causes a heavy russeting of varieties that are most susceptible to this type of injury.

A bacterial spot of Lima beans was observed by W. B. Tisdale, near Racine, in 1917, and later the same disease was found at Madison. The disease spreads to the upper leaves throughout the season and by the latter part of August the plants are said to be so badly infected that many of the blossoms and young buds are shed. The disease reappeared in 1919 and 1920, and a study of the disease under greenhouse and field conditions is in progress.

The bacterial blackleg of potato, long known in Germany, was observed in Wisconsin in fields of Early Ohio potatoes, J. Monteith reporting as high as 26 per cent of the plants showing presence of the disease.

J. C. Walker is continuing his studies on onion diseases and has found that red and yellow onions are highly resistant to onion smudge, while white varieties are very susceptible. Extracts from colored onions are found to be very toxic to the spores of the parasite which causes the disease, while those from white onion are not, and efforts are being made to isolate the compound which is responsible for this resistance.

The effect of dry heat upon seed germination and disease control has been further tested by J. G. Dickson, and barley was found to withstand heating for longer periods than wheat without injury to germination or reduction of vigor. Wheat germinates after long periods of heating, but yields are said to be greatly reduced. It is reported that a three-hour treatment of 100° C. controlled wheat scab and seedling blight and greatly reduced the smuts of these crops. This period of exposure, however, proved too short to kill the fungus of the organism of barley stripe within the seed. Soaking the seed in formaldehyde, followed by the dry-heat treatment, is believed to promise success in controlling the stripe disease.

An account is given of the wheat scab, blight of wheat seedlings, and root rot of corn, all of which are due to attacks by the same organism. For the control of this disease Dickson recommends planting wheat as early in the spring as possible or as late in the fall as is safe, both plantings apparently controlling the seedling blight. On the other hand, corn should not be planted until the last safe date, or until the soil has become considerably warmed.

Some further studies on the cucumber mosaic by S. P. Doolittle have demonstrated that the wild milkweed (*Asclepias syriaca*) is a host for this disease, and that it may be transferred from one plant to another by aphids as well as by the striped cucumber beetle.

A study of certain fusarial diseases of plants, E. F. Hopkins (*Missouri Sta. Bul. 179 (1921), p. 21*).—The author briefly reports investigations on corn root rot and wheat scab. The experimental results obtained are said to indicate that corn seed from an apparently healthy ear may harbor fungus mycelium near the tip of the grain in the darkened layer covering the scutellum. Six different organisms are said to have been associated with these infected areas, and some of them were found capable of invading the tissue of living, healthy corn roots under laboratory conditions.

The work on wheat scab has included a survey of the State to determine the distribution and amount of damage done. Isolations of the fungus from specimens of scabby wheat received from different parts of the State showed that 75 per cent were pure cultures from a Fusarium of the Giberella type, and over half of them produced perithecia of *G. saubinettii* in culture.

Seed-coat injury and viability of seeds of wheat and barley as factors in susceptibility to molds and fungicides, A. M. Hurd (*Jour. Agr. Research [U. S.], 21 (1921), No 2, pp. 99–122, pls. 11*).—The author gives the results of a co-operative study between the California Experiment Station and the Bureau of

Plant Industry of the U. S. Department of Agriculture, in which some of the factors, especially the physical condition of the seed coats, which enable saprophytes to attack seed, and the relation of mechanical injuries sustained by the seed coat, and treatment of injury are investigated. The fungi used for experimental infections were *Penicillium* sp. and *Rhizopus nigricans.*

The author found that unbroken seed coats ordinarily afford absolute protection against attack by the above-mentioned molds. Infections of such seeds may be obtained, however, by retarding germination of the seed by means of low temperatures. Breaks in the seed coat determine the ability of saprophytic fungi to invade seeds, either in the soil, in storage, or in blotter germinations. If the injury to the seed coat was over the endosperm, 100 per cent fatal infections resulted when spores were present, but if the injury was over the embryo, the seed remained practically immune to attack. Death or injury to seed resulting from seed treatment, or other cause, was found to render previously immune seeds susceptible to fungus invasion.

The effect of copper sulphate on wheat and barley, particularly with reference to the condition of the seed coats, was investigated, and where breaks in the testa over the endosperm of wheat were observed, no injury followed short exposure to copper sulphate. Similar breaks over the embryo, however, resulted in its death after exposures of only 3 to 5 minutes. When seed coats were badly injured, liming did not prevent extreme injury. Stunted roots, rather than injured plumules, are said to be characteristic of copper sulphate injury, because machine thrashing usually breaks the seed coat over the radicle. The amount of damage that will be done to seed wheat by the copper sulphate treatment can be predicted by an examination of the physical condition of the seed. Perfect seed coats were also found an absolute protection against short exposures to strong formaldehyde solutions and a partial protection against post-treatment injury after disinfection with formadehyde.

The inheritance of rust resistance in a family derived from a cross between durum and common wheat, L. R. WALDRON (*North Dakota Sta. Bul. 147 (1921), pp. 3–24, figs. 2*).—This bulletin deals with the genetics of resistance and susceptibility of stem rust in a series of plants which arose from a cross between Kubanka, an amber durum, and Power Fife, a hard red spring wheat. The cross was made in 1908, and a number of types were selected and studied in 1916.

The plants were separated into two groups, resistant and nonresistant. Eight plants selected from the more heavily rusted group proved to be heterozygous in later generations, and families were isolated which bred true to resistance and susceptibility. The plants heterozygous to rust resistance were found intermediate in their behavior toward susceptibility and resistance, and the author considers that more than one factor is responsible for resistance to rust. Linkage was found to occur between the characters defining durum wheat and resistance to stem rust, and a similar condition is considered to exist in regard to common wheat and susceptibility to stem rust. It is suggested that a simultaneous crossing over may explain a common wheat type heterozygous to resistance to stem rust and conditioned by at least two factors.

Flag smut of wheat and its control, W. H. TISDALE and M. A. GRIFFITHS (*U. S. Dept. Agr., Farmers' Bul. 1213 (1921), pp. 6, figs. 2*).—This disease, which was first observed in the United States in the vicinity of Granite City, Ill., in 1919, has spread somewhat, and in 1920 flag smut was found in the same region in 111 fields, comprising 2,500 acres. This disease has long been known in the wheat-growing sections of Australia, also in Japan, India, and South Africa. It is characterized by black stripes which run lengthwise in the leaf blades and sheaths. The stems are also affected to some extent, and infected plants are more or less dwarfed and rarely head out or produce seed. Flag smut is said to spread in two ways, by spores clinging to the seed and by means of spores in the soil. It is not known, however, how long the spores may retain their vitality in the soil.

In cooperation between the U. S. Department of Agriculture and the Illinois State Department of Agriculture, steps have been taken to prevent the spread of flag smut beyond the quarantined area in Madison, Ill., and to eradicate it if possible. The measures adopted include the treatment of all grain with formaldehyde as it comes from the separator, burning all straw, sowing no wheat on infested land, obtaining seed from localities known to be free from flag smut, and the treatment of all seed to be sown with copper sulphate. Marked differences have been observed in the susceptibility to this disease of several varieties.

Bacterial leaf-spot disease of celery, I. C. JAGGER (*Jour. Agr. Research* [*U. S.*], *21* (*1921*), *No. 3, pp. 185–188, pls. 2*).—In a previous publication (E. S. R., 33, p. 245) the author briefly described a disease of celery, due to an undetermined species of bacteria. In the present paper, which is a contribution from the Bureau of Plant Industry, U. S. Department of Agriculture, a more extended account is given of this disease, which is said to be due to *Pseudomonas apii*, n. sp., a technical description of which is given. As the result of spraying experiments carried on in a number of localities, it is claimed that the disease may be satisfactorily controlled by spraying with Bordeaux mixture, but not by the use of lime-sulphur solution.

Cotton diseases and their control, W. W. GILBERT (*U. S. Dept. Agr., Farmers' Bul. 1187* (*1921*), *pp. 32, figs. 18*).—Popular descriptions are given of wilt, root-knot, anthracnose, bacterial blight, shedding of bolls, rust, sore-shin, and Texas root-rot of cotton, and suggestions given for their control. In addition, a brief description is given of a number of minor diseases of the cotton plant.

Cotton root rot in the San Antonio rotations, C. S. SCOFIELD (*Jour. Agr. Research* [*U. S.*], *21* (*1921*), *No 3, pp. 117–125*).—In a contribution from the Bureau of Plant Industry, U. S. Department of Agriculture, the author discusses the crop rotation experiments carried on at San Antonio, Tex., in relation to the occurrence of cotton root rot in certain plats. Observations have been made since 1912 on the occurrence of the disease, and from a study of the history of the plats the author comes to the conclusion that the control of root rot can not be brought about by any ordinary system of crop rotation or by tillage methods.

The lettuce drop due to Sclerotinia minor, W. S. BEACH (*Pennsylvania Sta. Bul. 165* (*1921*), *pp. 27, figs. 6*).—A general account is given of drop disease of lettuce due to *S. minor*, a technical description of which has been previously noted (E. S. R., 44, p. 643).

This disease has been under observation by the author since 1918, when it was first noticed in Philadelphia County, Pa., where it was attacking lettuce grown in open fields. It has also been observed on lettuce grown in cold frames, but in this case the fungus appeared less aggressive than *Botrytis* sp. or *S. libertiana*. The author claims that, though limited in distribution, *S. minor* may surpass either *S. libertiana* or *Botrytis* sp. as a destroyer of lettuce. *S. minor* also attacks celery to a small extent, but is poorly adapted to vegetables in winter storage. When the different types of lettuce drop are compared, the author claims that *S. minor* can occur under drier or more unfavorable conditions and thus it appears more regularly, but that its rate of dissemination is slower, its seasonal prevalence different, and its distribution more local than in the case of *S. libertiana*. Under open field conditions, rotation of crops, destruction of old plants, rubbish, etc., roguing, and soil disinfection are recommended.

Cultural and morphological studies of *S. minor* are given in some detail.

Pink root disease of onions and its control in Texas, J. J. TAUBENHAUS and F. W. MALLY (*Texas Sta. Bul. 273 (1921), pp. 3–42, figs. 3*).—A detailed report is given of investigations on the pink root disease of onions and its control, preliminary accounts and the cause of the disease, which is due to *Fusarium malli*, having been previously noted (E. S. R., 37, p. 841; 40, p. 643). The rotation of crops has been found beneficial in reducing the amount of pink root, although it will not altogether eliminate the fungus from the soil. All onionlike plants should be excluded from rotations, and at least a three or four-year rotation is recommended.

Straighthead of rice and its control, W. H. TISDALE and J. M. JENKINS (*U. S. Dept. Agr., Farmers' Bul. 1212 (1921), pp. 16, figs. 7*).—A description is given of straighthead of rice, which is said to be one of the most destructive diseases of rice in the southern part of the United States. The investigations, which were in cooperation with the Louisiana Stations, show that straighthead is caused by certain unfavorable soil conditions and is most prevalent on virgin soil, especially on land in which nonirrigated crops have been grown for a number of years preceding the rice crop. All parts of the plant are affected, including the root system. The leaves are said to be darker green and somewhat stiffer than normal leaves. One or both glumes in a flower may be absent and the flower remain sterile. In severe cases the plants fail to head.

Straighthead can be prevented by the proper aeration of soils which are in a condition to reduce the disease. The authors recommend for the prevention of this trouble irrigation of the rice about 10 days after the plants emerge. If symptoms of the disease appear the land should be drained six weeks after irrigation and allowed to dry for two or three weeks. When the plants begin to turn yellow and show signs of wilting, water should again be applied and retained for the remainder of the season.

Sugar-cane diseases, C. W. EDGERTON and C. C. MORELAND (*Louisiana Stas. Rpt. 1920, pp. 16, 17*).—Notes are given on sugar-cane diseases observed by the authors during the year, and attention is called to the fact that the mosaic disease spread very rapidly during 1920. There is said to be now a very heavy infection all along the river plantations, the disease is present to a considerable extent along Bayou Lafourche, and it is also appearing in isolated places in the western part of the sugar belt of the State. Recent observations are said to bear out those of previous years that the L–511 seedling is the most resistant to mosaic disease of any of the important varieties of the State. Experiments show that the D–95 cane is extremely susceptible to the mosaic disease.

A dangerous tobacco disease appears in the United States, E. F. SMITH and R. E. B. MCKENNEY (*U. S. Dept. Agr., Dept. Circ. 174 (1921), pp. 6*).—In response to an urgent request of Florida tobacco growers, an investigation was made the latter part of March, 1921, of seed beds near Quincy, Fla. These beds were found badly infected with a mildew that is different from any tobacco disease previously observed in the United States. Further investigation showed that the disease was present not only in Florida but had spread to Decatur County, Ga., and by April 14 it was considered probable that all the seed beds in Gadsden County, Fla., and Decatur County, Ga., were more or less infected.

The disease is said to be apparently due to *Peronospora hyoscyami*, originally described from the black nightshade in Europe. The same fungus has been reported in tobacco seed beds in Australia and in South Africa, and as occurring in the wild tobacco plants in southern California. Preliminary to other investigations the authors recommend for the control of this disease the use of sterilized soil in seed beds, seed of undoubted purity, and hygienic measures in the care of seedlings. It is also believed that plants from infected beds should not be set in the field. Attention is called to this disease so that tobacco planters throughout other regions of the United States may be on their guard against its introduction.

Suggestions to growers for treatment of tobacco blue-mold disease in the Georgia-Florida district, E. F. Smith and R. E. B. McKenney (*U. S. Dept. Agr., Dept. Circ. 176* (*1921*), *pp. 4*).—In view of the possible seriousness of the downy mildew on tobacco, reported above, the authors suggest seed bed and field treatments that are believed will be advantageous in holding the disease in check or in eradicating it.

Bacterial spot of tomato, M. W. Gardner and J. B. Kendrick (*Jour. Agr. Research* [*U. S.*], *21* (*1921*), *No. 2, pp. 123–156, pls. 5*).—In a contribution from the Indiana Experiment Station, the authors give an account of the symptoms of a bacterial spot of tomato, and the isolation, pathogenicity, cultural characters, overwintering, and dissemination of the causal bacterium.

Bacterial spot of tomato is said to be a typical spot disease of the fruits, stems, and foliage, and practically all varieties of tomatoes have been found susceptible. Peppers and potatoes are also susceptible to some degree. The worst damage is due to the fruit lesions, although the disease is somewhat destructive among seedlings and occasionally as a foliage trouble in the field. The organism has been isolated and designated as a new species named *Bacterium exitiosum*. Foliage infection by atomizer inoculation is said to be readily obtained. Fruit infection occurs only through punctured wounds. Inoculation of mature fruit is usually unsuccessful, and this is attributed to the fact that the mature fruits have a higher hydrogen-ion concentration than the immature fruits or foliage. The organism is said to overwinter on the surface of tomato seed, and the disease may also be disseminated with diseased transplants. As a control measure disinfection of tomato seed in mercuric chlorid (1:3,000) for five minutes, to be followed by thorough washing, is recommended.

Tomato bacterial spot and seed disinfection, M. W. Gardner and J. B. Kendrick (*Indiana Sta. Bul. 251* (*1921*), *pp. 15, figs. 10*).—This is a nontechnical bulletin describing results of investigations noted above.

Botrytis rot and wilt of tomato, R. C. Thomas (*Ohio Sta. Mo. Bul. 6* (*1921*), *No. 3–4, pp. 59–62, figs. 3*).—A popular account is given of the occurrenec of a blossom-end rot of tomatoes under greenhouse conditions, which is also characterized by a wilt of the plants due to a girdling of the stems by the organism.

Infected tomatoes are said to have shown water-soaked spots which became slightly sunken and spread rapidly. Later the decaying portions turned ashy gray and finally brown in color. After the invasion of the stem end of the fruit had become general the larger fruits became detached, but frequently before this occurred the fungus had spread through the fruit spur and the main stalk girdling it, resulting in a rapid wilt of the distal portion of the plant. Inoculation experiments with water-spore suspension of the fungus failed to produce disease, but when pieces of diseased plant tissue were placed in contact with the stalks of healthy plants infection occurred after five days in a moist atmosphere. The results obtained are believed to indicate that infection develops only after the Botrytis fungus has survived for any time as a saprophyte. For the control of this disease the author suggests the avoidance of excessive watering and the giving of sufficient ventilation to lower the atmospheric moisture content.

Collar rot of tomato, F. J. PRITCHARD and W. S. PORTE (*Jour. Agr. Research [U. S.], 21 (1921), No 3, pp. 179–184, pls. 5*).—The results are given of investigations carried on in the Bureau of Plant Industry, U. S. Department of Agriculture, of a new disease of tomato seedlings which took the form of a rotting and girdling of the stems at the surface of the soil. This disease has been reported for the past three years as causing heavy loss in Maryland, New Jersey, and Delaware. It is said to be chiefly a seed-bed disease, plants infected in the seed bed carrying the disease to the field. Field infections are said to occur, but they are not very common.

From collar rot material a Verticillium was isolated that was found to infect tomato seedlings readily, and the present paper contains results of inoculation experiments with three species, *Verticillium lycopersici, Macrosporium solani,* and *Rhizoctonia solani.* The Verticillium proved to be a new species, which is described under the name *V. lycopersici.* The inoculation experiments showed that the collar rot and girdling of stem could be produced by all three of the fungi investigated, *V. lycopersici* and *M. solani* infecting tomato seedlings about equally well and causing typical lesions on 65 to 100 per cent in all plants inoculated, while Rhizoctonia produced a few infections of a superficial nature. The stems of potato and horse nettle were found to be infected by all three fungi, producing collar rot lesions in about the same proportion as mentioned above for the tomato.

Studies on tomato leaf-spot control, W. H. MARTIN (*New Jersey Stas. Bul. 345 (1920), pp. 43, figs. 4*).—Results are given of experiments conducted by the author to determine whether or not the leaf spot of tomatoes, caused by *Septoria lycopersici,* could be controlled by spraying. At the same time, investigations were made to determine the means by which the causal organism was disseminated.

Insects were found to carry large numbers of the spores, and wind and water were likewise found to function in the distribution of the leaf-spot organism. Pickers were found to carry large numbers of the spores on their hands and garments, and as a result the author suggests that picking tomatoes should be delayed after a rain or heavy dew until the plants are quite dry.

Studies on disease control have shown that while increased yields have been secured from the use of Bordeaux mixture, very little control resulted. Formulas of Bordeaux mixture to which soap was added were tested, and the best control was secured with Bordeaux mixture to which 3 lbs. of soap was added. As a result of these investigations, it is claimed that ordinarily it is not necessary to spray plants in the seed bed in New Jersey for the control of leaf spot. It would appear also that early applications in the field are not necessary, but the first application of the fungicide should not be made later than July 1. It is not believed that the presence of Bordeaux mixture on the plant had any direct influence on the ripening period, and under certain conditions the advisability of spraying late varieties of tomatoes is considered questionable. The author claims that leaf spot may be controlled by thorough timely spraying, but a few applications made indiscriminately will not give satisfactory results.

Apple rosette, O. M. MORRIS (*Washington Sta. Bul. 158 (1920), p. 27*).—Surveys are said to have shown that apple rosette does not occur in any orchards other than those on alkali soils, and investigations have demonstrated that the use of legume cover crops in the orchards may cause the trees to recover and resume normal growth. Chemical analyses of badly rosetted twigs, as compared with normal ones, showed that the ash and alkali content of the rosetted material was much higher than that of normal material. All of the work thus far carried on is believed to indicate that the accumulation of alkaline salts in the apple trees is at least a contributing factor to the development of this abnormal formation.

A bacterial bud rot of cannas, M. K. Bryan (*Jour. Agr. Research [U. S.], 21 (1921), No. 3, pp. 143–152, pls. 8*).—An account is given of bud rot of cannas, a hitherto undescribed disease that has been found to be due to *Bacterium cannae* n. sp. This disease has been studied by the author in the Bureau of Plant Industry of the U. S. Department of Agriculture, since 1918, and is considered to be primarily one of young tissues and moist conditions. Infection takes place through the stomata and spreads through the intercellular spaces of the parenchyma of leaf blade, petiole, and stalk. It is most destructive early in the season and begins in the hothouse and continues in the open beds. It destroys buds, causing formation of large unsightly spots on the leaves, and ruins the blossom clusters by blighting the flower buds or by decaying the stalk. No means for control have been worked out as yet, but it is recommended that healthy stock be selected for planting, that care be observed to avoid crowding and overwatering, and that good ventilation be maintained for plants in the house. Some differences in varietal susceptibility have been noted, and those especially subject to the disease should be discarded.

A chlorosis of conifers corrected by spraying with ferrous sulphate, C. F. Korstian, C. Hartley, L. F. Watts, and G. G. Hahn (*Jour. Agr. Research [U. S.], 21 (1921), No. 3, pp. 153–171, figs. 4*).—In a joint contribution from the Forest Service and the Bureau of Plant Industry, U. S. Department of Agriculture, the authors give an account of experiments on the control of chlorosis of conifers in a number of forest nurseries in the western part of the United States.

The disease is said to affect all conifer species grown in the forest nursery in Idaho, and associated with chlorosis was found poor growth of roots, stems, and leaves, failure to form normal terminal buds, and susceptibility to winter injury. Following the successful treatment of pineapple chlorosis with iron sulphate solution (E. S. R., 36, p. 850), the authors sprayed the young conifers with solutions and found that at the Pocatello Nursery chlorosis of the western yellow pine was corrected by spraying with a 1 per cent solution at 10-day intervals. The solution was used in sufficient quantities to wet the tops of the seedlings thoroughly. The 2 per cent solution, while correcting chlorosis, caused chemical injury to practically all the plants. The control of chlorosis in jack pine and western yellow pine at the Morton Nursery in Nebraska by spraying with a 1 per cent solution of iron sulphate was so successful that this method of treatment has been adopted as a regular nursery practice.

ECONOMIC ZOOLOGY—ENTOMOLOGY.

Wild ducks and duck foods of the Bear River marshes, Utah, A. Wetmore (*U. S. Dept. Agr. Bul. 936 (1921), pp. 20, pls. 4*).—This is a report on the abundance, food supplies, and general conditions affecting the wild ducks and geese breeding on the Bear River marshes in Utah or frequenting this region at other times of the year before their migrations to other parts of the United States.

The development of entomology in North America, W. J. Holland (*Ann. Ent. Soc. Amer., 13 (1920), No. 1, pp. 1–15*).—This is the annual presidential address delivered before the Entomological Society of America at St. Louis, Mo., in December, 1919.

Symposium on the life cycle in insects (*Ann. Ent. Soc. Amer., 13 (1920), No. 2, pp. 133–201, figs. 4*).—The life cycle in insects is dealt with as follows: Apterygota, by J. W. Folsom (pp. 133–137; The Life Cycle of the Orthopteroid Orders, by E. M. Walker (pp. 137–141); The Life Cycle in Hemiptera (Excluding Aphids and Coccids), by E. D. Ball (pp. 142–155); The Life Cycle of Aphids and Coccids, by E. M. Patch (pp. 156–167); The Life Cycle of the Lepidoptera, by S. B. Fracker (pp. 167–173); The Life Cycle of the Coleoptera (Including the Strepsiptera), by R. N. Chapman (pp. 174–180); The Life Cycle of the Diptera, by C. L. Metcalf (pp. 180–189); Hymenoptera, by T. D. A. Cockerell (pp. 190–192; and The Life Cycle of Insects, General Discussion, by S. A. Forbes (pp. 193–201).

[Report of the entomological work] (*Idaho Sta. Bul. 122 (1921), pp. 33, 34, 38, 39, 40, 41, figs. 1*).—Work with the clover aphis, in continuation of that previously reported (E. S. R., 40, p. 354), has shown that fields may be grazed closely with sheep as late as the first week in July and yet mature a full seed crop. On several fields cut back between July 1 and 15, a small second hay crop was obtained. Both of these measures are effective in preventing the aphids from attacking the seed crop.

Approximately three-fourths of the second-year red clover fields in the lower Snake River Valley were destroyed during the fall and winter by the red clover eelworm (*Tylenchus dipsaci* Kühn). In observations made during June and July, it was determined that infestation by the alfalfa weevil had increased from 15 to 21 counties. Life history studies of the codling moth were made in over 20 orchards from New Plymouth to Weiser. The studies showed that the first brood of moths emerged over a long period, there being really two peaks to the brood, one about June 14 and the other approximately July 1.

In spraying experiments with the San José scale, in which comparative tests were made of the efficiency of a number of standard spray materials, including lime sulphur and miscible oils, all proved to be effective.

Report of the entomological section, R. H. PETTIT (*Michigan Sta. Rpt. 1919, pp. 270–277, figs. 8*).—The first part of this report consists of a discussion of the occurrence of some of the more important insect pests of the year, during which a number of unusual insects appeared. The clover jassid or leafhopper (*Agallia sanguinolenta*) occurred in the southern part of the State on clover, and at Centerville destroyed from half to three-fourths of the crop in some fields.

The potato leafhopper, which causes tipburn, was controlled by a spray of nicotin sulphate, applied before the leafhoppers acquired their wings. It is pointed out that, since this insect passes the winter in hiding under rubbish, the destruction of all rubbish in late fall is the one way to gain permanent control.

The spittle insect *Philaenus leucophthalmus fasciatus* was very plentiful on clover at Chatham, in the Upper Peninsula Substation fields. The army worm appeared in several southern counties, while the erratic army worm (*Noctua fennica*) appeared in cut-over districts in the north, but, being confined to nonagricultural sections, it did very little damage except to gardens. A crambid, or grass webworm, injured young corn by boring through the roots and stalks, at the same time spinning webs about the roots. In the campaign against grasshoppers, which for several years have been bad in a number of counties, a poisoned sawdust bait is being used with success. It consists of 1 bu. of hardwood sawdust, 1 lb. white arsenic, 1 lb. (scant) salt, 0.5 pt. molasses, and water to make a stiff mash.

A summary of information on the wheat jointworm (*Isosoma tritici*) is presented by R. H. Pettit and E. McDaniel (pp. 272–276). An outbreak took place during the summer of 1918, which was the third that has been observed in Michigan, the others having occurred in 1884 and in 1905 and 1906. In addition to wheat, rye is sometimes slightly and barley often badly, attacked. Several hundred samples of infested straw from standing grain, collected for the most part from the southern half of the State, were kept under observation in cages. During the summer thousands of parasites, representing five species, emerged from the straw. The parasites reared, in order of their importance, are *Ditropinotus aureoviridis*, *Homoporus chalcidophagus*, *Eupelmus alynii*, *Eupelminus saltator*, and *Eridontomerus pruinosa*. These parasites were pretty generally distributed over the southern half of the State, the Ditropinotus being by far the most important. Another parasite, *Eurytoma bolteri*, which closely resembles the jointworm itself in the adult stage, was reared from the infested straw. The jointworm situation during 1919 is said to have been markedly improved, whereas the more serious species, known as the sheath jointworm (*I. vaginicola*), which produced comparatively few parasites in cages, was still plentiful and possibly worse than in 1918. *I. vaginicola*, however, was not so widely distributed, being confined more especially to the eastern part of the State.

[Report of the department of] entomology, L. HASEMAN, S. R. MCLANE, and K. C. SULLIVAN (*Missouri Sta. Bul. 179* (*1921*), *pp. 26–30*).—Investigations of the Hessian fly resistant qualities of different varieties of wheat, reported upon in tabular form, show Illinois Chief and Zieglers Choice to be the most resistant, with 5 and 7 per cent infestation, respectively, and Miracle, with an infestation of 50 per cent, to be most susceptible. Observations of the annual life cycle of the Hessian fly substantiate the earlier studies.

Treatment of 13 varieties of corn with arsenate of lead, at the rate of 1 lb. (dry) to 50 gal. of water, and of other plants of these varieties with equal parts of dry arsenate of lead and hydrated lime, for the control of the bollworm, failed to give any special results.

In codling moth studies, tests were made for the amount of lead arsenate placed in calyx cups by the use of different nozzles and at different pressures. It was found that a pressure of from 75 to 150 lbs. and a reasonably fine mist nozzle, like the Disk, would place as much as, or more poison in the inner calyx cup than, a higher pressure and a coarser nozzle.

Reference is made to studies of insects injurious to nursery stock and to insects affecting melon and related crops.

[Report of the] division of entomology and zoology, A. L. MELANDER (*Washington Sta. Bul. 158* (*1920*), *pp. 21–23*).—In spraying work with the codling moth, conducted at Cashmere, Opportunity, and Moran, with a view to determining the relative value of various treatments, the coefficient method of rating, an account of which has been previously noted (E. S. R., 44, p. 655), has shown a slight advantage in favor of the clipper nozzle over the spray-gun at the calyx application. Powdered arsenate of lead gave slightly better results than calcium or magnesium arsenates, and proved somewhat better than the paste form. No scorching was caused by calcium arsenate even where the lime sulphur was omitted. There was not sufficient improvement to warrant use of a spray much stronger than 1 lb. of powdered lead arsenate to 75 gal. The addition of 4 to 6 bars of laundry soap aided materially in increasing the covering ability of the spray. Late sprayings proved to be very necessary in the orchards under treatment, which were selected because of particularly heavy infestation.

Brief reference is made to winterkill of San José scale, a report upon which by Spuler has been noted from another source (E. S. R., 44, p. 654). The leaf roller in the Spokane district was the most startling orchard pest of the year.

[Work with bees and insect pests] (*Wisconsin Sta. Bul. 323* (*1920*), *pp. 42–46, figs. 3*).—The work discussed includes the occurrence of bee diseases in the State, where 8,000 persons kept bees; the cause of winter losses with bees; establishing or restocking apiaries by means of package bees; pea moth investigations, a bulletin relating to which has been noted (E. S. R., 43, p. 257); and the occurrence of several of the more important pests of the year.

A bibliography on fungus insects and their hosts, H. B. Weiss (*Ent. News, 32 (1921), No. 2, pp. 45–47*).—This list, which is arranged by orders and includes only references to American literature, is said to be as complete as is possible to make it.

Additional fungus insects and their hosts, W. B. Weiss and E. West (*Biol. Soc. Wash. Proc., 34 (1921), pp. 59–61*).—This supplements the paper previously noted (E. S. R., 43, p. 659).

[Horticultural inspection] (*Jour. Econ. Ent., 14 (1921), No. 2, pp. 160–172; 178–205*).—Papers presented before the Section of Horticultural Inspection of the American Association of Economic Entomologists, at Chicago, December 30, 1920, include the following: The Trend of Horticultural Inspection, by J. G. Sanders (pp. 161–166); Activities of the Federal Horticultural Board on the Texas-Mexican Border, by O. D. Deputy (pp. 178–183); Standardized Nursery Inspection, by F. M. O'Byrne (pp. 183–188); Some Problems in Greenhouse Inspection Work in Indiana, by H. F. Dietz (pp. 188–194); Plant Quarantine Work at Florida Points, by J. H. Montgomery (pp. 195–200); and The Operation of Quarantine No. 37, by R. K. Beattie (pp. 201–204).

Dusting v. spraying of apples, A. L. Quaintance (*Jour. Econ. Ent., 14 (1921), No. 2, pp. 220–225*).—Some of the results obtained by the Bureaus of Entomology and Plant Industry, U. S. Department of Agriculture, during the last few years in dusting apple orchards in comparison with spraying are reported in tabular form. The experiments were conducted at Benton Harbor, Mich., Winchester, Va., Bentonville, Ark., Wallingford, Conn., and Grand Junction, Colo.

The following general conclusions in regard to the codling moth and plum curculio, based upon the work with apples, are considered warranted: "In regions where the codling moth is not especially severe, as in the New England States and other more northern States, dusting controls this insect practically as well or as well as spraying. In regions where the codling moth is more abundant, due to a larger second brood or to subsequent broods of larvae, as in Maryland, Virginia, Illinois, the Ozarks, etc., dusting is not a satisfactory control. In such arid regions as the Grand Valley, Colo., where the codling moth is very prolific and injurious, dusting is notably less effective than spraying.

"In the case of the plum curculio on apples, dusting compares favorably with spraying where the insect is not especially abundant. Under conditions of curculio abundance, as is often the case in orchards in sod, dusting is not an effective control for this insect, and spraying under these conditions may not furnish the protection desired."

It is stated that considerable work has also been done in dusting peaches in comparison with spraying for the control of the plum curculio, scab, and brown rot in different parts of the country, but that little of this work has been entirely satisfactory from the experimental standpoint, owing to the scarcity in the same orchard of one or more of these troubles. "The most conclusive results obtained come from Mississippi and Georgia and indicate that, during periods of average abundance and under average weather conditions, dusting is about as effective as spraying for these three peach troubles."

[Dust mixtures for insect control] (*Jour. Econ. Ent., 14 (1921), No. 2, pp. 205–238, fig. 1*).—Papers on this subject presented in the symposium of the joint meeting of the American Association of Economic Entomologists and the American Phytopathological Society, at Chicago, on December 31, 1920, include the following: Control of Sucking Insects with Dust Mixtures, by P. J. Parrott (pp. 206–214); Dusting as a Means of Controlling Injurious Insects, by T. J. Headlee (pp. 214–220); Dusting *v.* Spraying of Apples, by A. L. Quaintance (pp. 220–225), noted above; and Orchard Dusting *v.* Spraying, by N. J. Giddings (pp. 225–238).

Insects injurious to deciduous shade trees and their control, J. Kotinsky (*U. S. Dept. Agr., Farmers' Bul. 1169* (*1921*), *pp. 100, figs. 64*).—This is a popular source of information on the more important insects affecting deciduous shade trees in the eastern two-thirds of the United States, excepting the gipsy and brown-tail moths, and means for their control.

A new genus of termite guest from Fiji, W. M. Mann (*Psyche, 28* (*1921*), *No. 2, pp. 54–56 fig. 1*).

The process of hatching in Corydalis cornuta L., R. C. Smith (*Ann. Ent. Soc. Amer., 13* (*1920*), *No. 1, pp. 70–74, figs. 2*).

Orthoptera of Maine, A. P. Morse (*Maine Sta. Bul. 296* (*1921*), *pp. 36, figs. 25*).—This is a summary of information on the grasshoppers and related insects occuring in Maine, including an annotated list of 74 forms occurring in the State.

Hippiscus olancha Caud., an apparently undescribed grasshopper from California (Orthop., Acrididae), A. N. Caudell (*Ent. News, 32* (*1921*), *No. 5, pp. 149–151*).

Possible use of a trap to control leafhoppers injurious to fruit trees, G. W. Barber (*Jour. Econ. Ent., 14* (*1921*), *No. 2, p. 240*).—In the course of investigations of the European corn borer at Arlington, Mass., the author found that a macerated grapefruit placed in a cage in a large apple tree was highly attractive to *Empoa rosae*, with which the tree was severely infested. Several days after the bait was placed the cage was completely covered with thousands of adults of the leafhopper. Since the trap was placed on the trunk of the tree 4 ft. from the ground and at least 3 ft. from the nearest foliage, it is concluded that this bait is highly attractive and may be made practical use of.

Some studies on the influence of environmental factors on the hatching of the eggs of Aphis avenae Fab. and A. pomi DeG., A. Peterson (*Ann. Ent. Soc. Amer., 13* (*1920*), *No. 4, pp. 391–401, figs. 6*).—This is a report of studies conducted in connection with investigations previously noted (E. S. R., 42, p. 250).

Note on the rosy aphis, A. C. Baker (*Canad. Ent., 53* (*1921*), *No. 4, p. 95*).—The author records the discovery of the type *Aphis malifoliae* Fitch since the preparation of the paper previously noted (E. S. R., 36, p. 356). He finds that it represents *A. crataegifoliae* Fitch. Since the rosy aphis is without a name, as all former names given it refer to different insects, the name *Anuraphis roseus* is proposed.

The Coccidae, A. D. MacGillivray (*Urbana, Ill.: Scarab Co., 1921, pp. VIII+502*).—This consists of tables for the identification of the subfamilies and some of the more important genera and species, together with discussions of their anatomy and life history. The materials here presented were originally collected for the use of students in the identification of coccids. An introduction is followed by chapters on preparation, external anatomy, and classification, 17 chapters relating to as many subfamilies, and 6 chapters relating to as many tribes. The work includes a bibliography of nine pages and an index to the subject matter, including genera and species.

A review of MacGillivray's The Coccidae, G. F. Ferris (*Conad. Ent., 53* (*1921*), *Nos. 3, pp. 57–61; 4, pp. 91–95*).—A review of the work above noted.

The Coccidae of South Africa, V, C. K. Brain (*Bul. Ent. Research, 11* (*1920*), *No. 1, pp. 1–41, pls. 4*).—In this continuation of papers previously noted

(E. S. R., 44, p. 853), the genera Allopulvinaria, Conofilippia, Idiosaissetia, and Membranaria are erected, and 56 additional forms listed, of which 29 are described as new.

The present status of the gipsy moth in New Jersey, T. J. HEADLEE (*Jour. Econ. Ent., 14 (1921), No. 2, pp. 172–178*).—The author records the occurrence of the gipsy moth in New Jersey at Duke's Park near Somerville, where it was discovered in July, 1920, having been introduced with shipments of blue spruce trees from Europe in 1910 and 1911. Ninety square miles in the Somerville area were found to be scatteringly infested. Intrastate shipments appear to have resulted in infestations at Glen Rock, Wyckoff, Paterson, Elizabeth, South Orange, Mendham, Scotch Plains, and Deal Beach. The work of control now under way is discussed.

The apple leaf-crumpler as a pest of Cotoneaster, H. B. WEISS (*Canad. Ent., 53 (1921), No. 4, pp. 73–75*).—*Mineola indiginella* Zell., which normally feeds on apple, quince, plum, cherry, peach, and pear is recorded as injuring Cotoneaster, notably *C. microphylla* and *C. horizontalis*. in a nursery at Rutherford, N. J., where they are grown as ornamental shrubs.

New synonymy in a recent paper on the European corn borer, C. HEINRICH (*Ent. News, 32 (1921), No. 2, pp. 57, 58*).—This is a discussion of a paper by Flint and Malloch, previously noted (E. S. R., 43, p. 661).

Descriptions of new Central American Microlepidoptera, A. BUSCK (*Insecutor Inscitiae Menstrums, 8 (1920), No. 4–6, pp. 83–95*).

New species of Notodontidae from Central and South America (Lepidoptera), W. SCHAUS (*Insecutor Inscitiae Menstruus, 8 (1920), No. 7–9, pp. 147–161*).

The codling moth: A quandary and a query, G. W. HERRICK (*Jour. Econ. En., 14 (1921), No. 2, pp. 156–160*).—The most effective method of control of the codling moth is considered.

Life history of Recurvaria milleri, the lodgepole pine needle-miner, in the Yosemite National Park California, J. E. PATTERSON (*Jour. Agr. Research [U. S.], 21 (1921), No. 3, pp. 127–142, pls. 2, figs. 4*).—The lodgepole pine needle-miner (*R. milleri* Busck) infests the needles of *Pinus murrayana*, causing them to fade and later fall from the trees, resulting in defoliation in the infested areas. The only serious epidemics of the needle-miner which have been recorded occur in the lodgepole pine stands in the Yosemite National Park of California, where the investigation was conducted.

The occurrence of this pest over large areas in the Yosemite Park first came to the attention of the Bureau of Entomology, U. S. Department of Agriculture, in 1903, since which time its infestation has been increasing. Examinations in 1913 and 1914 indicated that the infestation was distributed throughout about 30,000 acres in the park, being limited, however, to lodgepole pine growing between the elevations of 7,000 and 9,000 ft. Much of the timber defoliated by the needle-miner has been attacked and killed by the mountain-pine beetle (*Dendroctonus monticolae*). Final and complete killing of the trees as a result of the needle-miner damage alone has not been recorded, although some of the more severely affected have reached a condition that offers little hope for their ultimate recovery.

"The length of the life cycle is 25 months, and covers a period of one year and parts of two other years. The individual broods hibernate during two winter periods of approximately six months each. The feeding periods of the larvæ occur during parts of three years, aggregating a total period of 11 months. Flight occurs every alternate year, as in 1913, 1915, 1917, and 1919. During the alternate years from flight the broods are found in the larval stage in the needles of the current or previous year's growth." Emergence and flight of the adults occur during the period from July 1 to August 31. The life cycle of the pest is diagrammatically illustrated.

The eggs are deposited on and under the needle sheaths at the base of the needles, and the larvæ begin to hatch out about August 5 and continue hatching until about September 10. By the latter part of October they have grown to be approximately 2 mm. long and have mined about one-third the outer length of the infested needles. Activity ceases during the latter part of October, and during the winter of the first season the insect hibernates as immature larvæ in the partially mined needles. Activity is resumed in early May of the next spring, and the brood develops as larvæ throughout the growing period of the second season, having mined two-thirds the length of the infested needles by the middle of July. About August 5, when new needles are nearly full-grown, the larvæ begin to leave the mined needles in which the previous winter was passed and migrate to the new needles. During the latter part of October the brood again ceases feeding and becomes dormant, passing the second winter as nearly mature larvæ in the first-attacked needles of the second season's growth. Activity is again resumed the following spring in early May. After completely mining the needles in which they hibernated, the needles are abandoned and the larvæ attack green needles of the same growth, which by the last of May are from one-half to three-fourths mined. The larvæ, now being full-grown, cease feeding and prepare the larval tunnels for pupation in the last-mined needles. Thus, by the time pupation begins, each larva has mined three needles during its life cycle of 23 months. Pupation, which takes place in the mined needles with the heads toward the tips, begins about June 10, and the adults begin to emerge about July 1.

Ten species of hymenopterous parasites have been reared from the prepupal larvæ, of which *Copidosoma* sp. and *Euteles* sp. are most abundant. The author concludes that the use of sprays, etc., in control of the pest is not practicable. It is pointed out that in many sites where the mature lodgepole pine has been killed out by bark-beetle epidemics following in the wake of the needle-miner invasions, mountain hemlock and fir are reproducing to a most encouraging extent, and that these latter species are more desirable for park purposes in many ways and are not subject to the epidemics which are killing the lodgepole pine.

The pecan-nut case bearer (Acrobasis caryaevorella), S. W. Bilsing (*Jour. Econ. Ent., 14 (1921), No. 2, pp. 149–153*).—Spraying experiments conducted over a period of several years in Texas, where *A. caryaevorella* is the most important insect enemy of the pecan industry, have led to the conclusion that it can best be controlled by the use of arsenate of lead against the first of the three generations, applied at the rate of 3 lbs. to 50 gal. of water, under a pressure of 250 lbs. In addition to two applications for the first brood larvae, a third spraying for the second brood, the latter part of June, is sometimes necessary.

Anopheles breeding among water lettuce—a new habitat, J. Zetek (*Bul. Ent. Research, 11 (1920), No. 1, pp. 73–75*).—Attention is called to the importance of floating islands of water lettuce (*Pistia stratiotes*) as a source of malaria infection.

The range crane flies in California, C. M. Packard and B. G. Thompson (*U. S. Dept. Agr., Dept. Circ. 172 (1921), pp. 8, figs. 5*).—This account relates to *Tipula simplex* Doane and *T. quaylii* Doane, the larvae of which badly injure California ranges, pastures, and grain and alfalfa fields during the rainy season. The forage on large areas of range land is often destroyed by the maggots, which sometimes become exceedingly abundant in spots, averaging as many as 300 to the square foot.

The females of both species and the male of *T. quaylii* are wingless. The eggs are deposited late in the winter in small masses mixed with soil, and the larvae hatch out during the first heavy rains of the following winter just as the grasses have sprouted, the eggs having remained dormant in the soil throughout the intervening dry season. By the end of January or early February the larvae become full grown and pupate just below the surface of the soil. The adults emerge in late February or in March and deposit their eggs within a few rods of the spot where they emerge from the ground.

Experiments conducted during the winter of 1920–21 in heavily infested areas resulted in from 50 to 90 per cent of the maggots being killed by the several different poisoned bran formulas tested. An average of 72 per cent of the total number present were killed by the use of the grasshopper formula, consisting of mollasses and lemons added to bran, Paris green, and water, and fully as high a percentage of mortality was obtained by the same formula without any of the flavoring. The results led the authors to recommend the use of 25 lbs. of bran, 1 lb. of Paris green, and sufficient water to make a flaky mash (about 3 gal.). Ten to 20 lbs. per acre of this bait was the smallest amount that gave uniformly high kill over the entire plat. Amounts larger than 20 lbs. per acre did not increase the effectiveness of the bait. When this is evenly and smoothly spread with a grain seeder, effective results can be probably be obtained with smaller amounts than when more or less unevenly sown by hand. "The poison should be sown broadcast over the entire infested area, rather than in strips, because this insect ordinarily does not travel far in search of food. The cost of this poison, applied as recommended above, is about 50 cts. per acre, not counting the labor of mixing and spreading."

On the reasons for the variation in the effects of formaldehyde as a poison for house flies, L. Lloyd (*Bul. Ent. Research, 11 (1920), No. 1, pp. 47–63, figs. 4*).—The author finds the effective action of formaldehyde as a fly poison to depend upon the freedom of the exposed fluid from formic acid. and, to a less extent, from methylamin. "That used for fly poisoning should, therefore, be colorless and free from a fishy odor, and a weak alkali, in slight excess, should be added in dilution to neutralize any acid present and that which will be formed during exposure. The formula recommended is 40 per cent formaldehyde 5 to 6 per cent, clear lime water 50 per cent, sugar 2.5 per cent, and water to make 100 per cent. This should be exposed in a trap which will protect it from the air and will prevent flies from falling in. Formaldehyde, like any other stomach poison for flies, will be most effective under dry conditions."

Notes on the Ethiopian fruit flies of the family Trypaneidae, other than Dacus, III, M. Bezzi (*Bul. Ent. Research, 10 (1920), No. 3, pp. 211–272, pls. 2*).—This continuation of papers previously noted (E. S. R., 39, p. 467) includes a systematic catalogue of 216 species, represented by 54 genera. Nine genera are erected and 29 forms described as new.

Review of the Nearctic Tetanoceridae [Sciomyzidae], A. L. Melander (*Ann. Ent. Soc. Amer., 13 (1920), No. 3, pp. 305–332, pl. 1, fig. 1*).—The author here gives synoptic keys to 22 genera, 89 species, and 8 varieties, of which 19 species are described as new to science.

Observations on Psyllobora taedata LeConte, a coccinellid attacking mildews, W. M. Davidson (*Ent. News, 32 (1921), No. 3, pp. 83–89*).—This is a report of anatomical and biological studies of a species which is found in all stages associated with fungus infestations of the mildew type. It appears to be especially attracted to rose and apple powdery mildew (*Sphærotheca pannosa* and *Podosphæra oxyacanthæ*, respectively).

Protection of mesquite cordwood and posts from borers, F. C. Craighead and G. Hofer (*U. S. Dept. Agr., Farmers' Bul. 1197 (1921), pp. 12, figs. 17*).—Attention is called to the importance of mesquite in the southwestern United States, where it is used for many purposes, particularly for fuel and fence posts, and to the fact that certain borers completely destroy mesquite wood in a few months after it is cut, causing great loss and inconvenience. Insects responsible for the damage include roundheaded borers, powder-post beetles, and flat-headed beetles. In the vicinity of Tucson, Ariz., where the experiments were conducted, there is only one roundheaded borer of much economic importance, namely, *Cyllene antennatus* White, but this is the most destructive insect in mesquite. Three powder-post beetles were found, namely, *Apatides fortis* Lec., *Dendrobiella aspera* Lec., and *Xylobiops* sp., and a flat-headed borer, *Chrysobothris octocola* Lec. In Texas another roundheaded borer (*Cyllene crinicornis* Chev.) and several other species of powder-post beetles (*Xylobiops* spp.) are equally numerous. The characteristics of the insects and their work, seasonal activity, and conditions favorable and unfavorable for attack are discussed.

It is pointed out that by cutting fuel wood at certain seasons and turning the more valuable products in the sun, practically all insect damage can be prevented. "Except for immediate use mesquite cordwood should not be cut during the spring and summer months. Wood which is cut between the middle of October and the latter part of January and which is loosely ricked, so that it quickly dries, is usually but little injured. The safest period, however, is from the middle of October to the end of November. Wood should not be stored longer than one year, after which much damage is done by the large powder-post beetle."

Arsenic for grub-infested soils, J. F. Illigworth (*Jour. Econ. Ent., 14 (1921), No. 2, pp. 238, 239*).—The author, working in North Queensland, reports that white grubs (*Isodon puncticollis* Macl.) attacking cucumbers in gardens are destroyed by sprinkling crude white arsenic (arsenious acid) through the soil of the hills at the rate of about 80 lbs. per acre. The arsenic had no injurious effect upon the growing plants even when used in excessive quantities, i. e., 200 lbs. per acre.

The winter of 1918–19 and the activities of insects with special reference to the clover leaf weevil (Hypera punctata Fab.), G. W. Herrick (*Ann. Ent. Soc. Amer., 13 (1920), No. 1, pp. 101–107*).—The discussion here presented accompanies a brief summary of weather conditions from November to April, inclusive, as recorded at the weather station at Cornell University.

Some injurious South African weevils, G. A. K. Marshall (*Bul. Ent. Research, 10 (1920), No. 3, pp. 273–276, pl. 1*).—*Prototsrophus planatus* and *P. instabilis*, both recorded as injuring the foliage of young orange trees in the Transvaal; *P. noxius*, found feeding on young wheat in the Orange Free State; and *Eremnus horticola*, found feeding on dahlias and chrysanthemums in the Orange Free State, are described as new.

Ant guests from Fiji and the British Solomon Islands, W. M. Mann (*Ann. Ent. Soc. Amer., 13 (1920), No. 1, pp. 60–69, figs. 9*).

A new pristomerine from California (Hym., Ichneumonidae), H. L. Viereck (*Ent. News, 32 (1921), No. 6, pp. 172–174*).

Notes on Hellén's Beiträge zur Kenntnis der Ichneumoniden Finlands: subfamilie Pimplinae, R. A. Cushman and S. A. Rohwer (*Insecutor Inscitiae Menstruus, 8 (1920), No. 7–9, pp. 161–163*).

[Dusting vegetables for insect control], H. J. Eustace (*Michigan Sta. Rpt. 1919, pp. 282–284*).—The Niagara Contact Special Dusting Mixture, consisting of sulphur 49 per cent, nicotin 0.25 per cent, and inert ingredients 50.75 per cent, was applied to cucumbers and squashes for aphids, with an Ideal Power Duster.

The results lead to the conclusion that " aphids can be controlled by the dusting method when conditions are such that the dust can be brought in contact with them. This can be done with such crops as cucumbers or muskmelons, but not with rank-growing vine crops, such as squash, excepting during their earlier periods of development."

A mixture of dry calcium arsenate 15 per cent and talc 85 per cent, applied to potatoes with an Ideal Power Duster, destroyed all the potato beetle larvæ and appeared to act more quickly than where the arsenical was applied as a spray.

Spray now to kill European red mite, W. E. Britton (*Connecticut State Sta. Bul. Immed. Inform. 13* (*1921*), *pp. 3*).—This relates to *Paratetranychus pilosus* C. and F., an account of which is given in the report previously noted (E. S. R.. 45 p. 149). Laboratory tests with commercial insecticides for its control in the egg stage have shown that miscible oils like Scalecide are more effective than lime sulphur, nicotin solution, or any of the other preparations tested. It is recommended that, as a means of control, Scalecide or some other miscible oil, 1 part in 15 parts of water, be applied so thoroughly that every twig and portion of the bark is covered.

The genus Trombicula Berl. in America and the Orient, H. E. Ewing (*Ann. Ent. Soc. Amer., 13* (*1920*), *No. 4, pp. 381–390, figs. 3*).—The author recognizes two species of Trombicula as occurring in the United States, namely, *T. splendens* Ew., described from Portage, Wis., in 1909, and *T. cinnabaris* n. sp., here described from East Falls Church, Va., and North Beach, Md.

A supplementary note to the biography of W. H. Patton, B. H. Ransom (*Ent. News, 32* (*1921*), *No. 5, p. 154*).

FOODS—HUMAN NUTRITION.

Some observations of corn meal in storage, L. H. Bailey and C. Thom (*Oper. Miller, 25* (*1920*), *No. 12, pp. 368–371, figs. 4*).—Experiments on the keeping qualities of corn in storage, begun by Winton et al. (E. S. R., 33, p. 259), have been continued at the Bureau of Chemistry, U. S. Department of Agriculture, to include studies of the keeping qualities of many grades of commercial corn meal under laboratory and commercial storage conditions. This paper reports a study of a commercially successful practice in which whole corn is milled with and without the removal of bran from the finished product.

For the experiment four lots of corn were selected and milled, half of each lot being bolted and the other half left with nothing removed from the whole corn. The percentages of moisture in the unbolted and bolted freshly milled products were, respectively, as follows: 16.62 and 16.22, 15.82 and 14.89, 13.98 and 14.17, and 12.86 and 12.5. Immediately after milling the meal was placed in cotton bags, 100 lbs. to the bag, and the bags were piled five deep on heavy paper on a cement floor in a well ventilated galvanized-iron building. The piles were arranged in two tiers, with plenty of room to walk around each tier, thus affording good circulation of air. Thermometers were placed in the centers of the bags at frequent intervals, and at no time did the temperature of the meal exceed 15° C. (59° F.). The samples were taken out each week during the period of storage from April until August, 1920, and were analyzed for moisture, acidity, and H-ion concentration.

The results of these analyses show a gradual decrease in moisture in all the samples to an approximately uniform content. The acidity increased with more or less regularity until about the middle of July. There was no evidence of heating, caking, or molding in any of the samples, and all were in a merchantable condition at the end of the experiment. The taste of the meal, especially in the bolted samples, was slightly sharper than that of fresh meal, but muffins baked from typical samples had no objectionable taste.

Subsamples of the meal packed in sterilized pint fruit jars and stored in the laboratory for the same length of time showed a marked contrast on examination and analysis. Samples of the lowest initial moisture content showed no physical signs of deterioration or differences in acidity. With increase in initial moisture content there was progressive increase in acidity and mold development.

These results show that for this lot of corn there was a critical moisture percentage at or below 13. Below this spoilage takes place very slowly, if at all, while above it the spoilage is rapid unless the meal is kept under conditions of temperature and ventilation which will prevent the growth of microorganisms. This is effected largely by the loss in water of the meal on prolonged storage, which tends to bring it down below the critical moisture content.

Rice as food (*U. S. Dept. Agr., Farmers' Bul. 1195, pp. 22, figs. 4*).—Information regarding the food value of rice, rice milling, and rice cooking is brought together, and standardized recipes are given. A section on wild rice, known to the Indians since pre-Columbian times and now fairly common in some markets, is included.

Milling and baking tests [with wheats grown on the North Dakota College demonstration farms], E. I. Olsen (*North Dakota Sta. Bul. 148 (1921), pp. 33–35, figs. 7*).—Results are reported in tabular form on milling and baking tests with hard red spring wheat (Marquis and Power Fife) and durum wheat (Kubanka, Arnautka, and Acme). Considerable variation was noted in the bread made from the same variety of wheat grown on the different farms.

The decomposition of the proteins of different varieties of milk into the usual assimilable forms through pepsin-hydrochloric acid and pancreatin, and the effect of the addition of electrolytes and nonelectrolytes, A. Gabathuler (*Fermentforschung, 3 (1920), No. 2, pp. 81–192, figs. 50*).—This article is essentially a plea, based on original investigations and abundant references to the literature, for the use of raw instead of pasteurized or boiled milk on account of its more ready digestibility, and for such a system of milk control as will enable the placing on the market of milk of such quality with respect to kind and quantity of bacteria that it can be safely used raw.

The necessity of clear thinking in milk modification, L. W. Hill (*Jour. Amer. Med. Assoc., 76 (1921), No. 10, pp. 633–637*).—The author describes briefly the methods of modifying cow's milk for infant feeding by whole milk dilution, top milk dilution, and gravity cream and skimmed milk mixtures.

Use more cheese, L. Brewer (*Cornell Reading Course for the Home, No. 133 (1920), pp. 31, figs. 2*).—In addition to a discussion of the selection and use of cheese, this publication contains a large number of recipes.

The preservation of meats, M. L. Matthews (*Purdue Agr. Ext. Bul. 95 (1920), pp. 12*).—This publication includes a brief outline of methods commonly employed for the preservation of meat, special directions for curing pork and beef, miscellaneous recipes, and general directions for the smoking of meats and the preservation of smoked meats.

The effect of blanching in the canning of some typical crops of vegetables, E. Geldehaus (*Missouri Sta. Bul. 179 (1921), p. 37*).—A study of the rate of heating of quart cans of spinach under different conditions is briefly reported. It required 15 minutes longer to bring to the boiling point spinach blanched by the steam and cold-dip method than when simply wilted in the top of a double boiler and packed directly into the jar. Increasing the amount of material in the jar from 1,000 to 1,500 gm. did not influence the time required for the center of the jar to reach the temperature of 100° C.

[Spoilage in canned corn], Z. NORTHRUP [WYANT] (*Michigan Sta. Rpt. 1919, pp. 240, 241*).—From a can of corn which had undergone a peculiar type of spoilage characterized by the development of no unpleasant odor or taste but a change in the appearance of the corn to a slimy consistency, the author has isolated an organism consisting of short rods in pairs or short chains.

"This bacillus is an example of the type of organisms very frequently found in spoiling canned foods, i. e., an organism difficult to isolate on account of its peculiar cultural requirements. This organism grows well on no medium used except corn agar and sterile corn and peas. This peculiarity of certain organisms is very frequently the explanation why certain spoiled canned goods are declared sterile or the organisms isolated do not show gas production in ordinary media."

Standardization of cooking temperatures, L. STANLEY and N. COLLIER (*Missouri Sta. Bul. 179 (1921), pp. 37, 38*).—In a study of baking temperatures for cakes as affected by the amount of baking powder used, cakes made according to a standard recipe were baked at eight temperatures ranging from 175° to 225° C. According to the authors, the baking temperatures had no effect on the specific volume or texture when a medium amount of baking powder was used. When eight teaspoonfuls of baking powder were used the volume of the cakes was greater than when one teaspoonful was used, but the increase was not regular. At all the baking temperatures the specific volume of cakes was slightly larger when one cake was baked at a time than when four cakes were baked, probably because "the temperature inside the cake was higher in a shorter length of time where one cake was baked than where four were baked." No relation was noted between the amount of baking powder and the water loss in baking, and after standing 24 hours and 48 hours, or in total water loss; nor between water loss and baking temperature.

The time required for baking was decreased as the temperature for baking was increased. The kind of sugar used had little effect on the specific volume of the cake, but it did have a marked effect on the texture, the best results being obtained with powdered or fine grained sugar.

The specific volume was greater when the egg white was beaten separately. Whether egg white was added last or before the baking powder, no difference in specific volume was noted. The greater the amount of batter, the greater the specific volume of the cakes.

Dietitians in hotel, E. M. STATLER (*Hotel Mo., 29 (1921), No. 340, pp. 67, 68*).—An account is given of the successful employment of dietitians trained in home economics to deal with the problems of feeding hotel employees in a large hotel in New York City. The success of the work there led to the employment of dietitians for similar purposes in large hotels in other cities.

Cost accounting for the country hotel, S. O. CHADWICK (*Hotel Mo., 29 (1921), No. 336, pp. 28–30*).—A system of cost accounting suited for a business of moderate size is described.

Textbook of physiological chemistry.—II, Inorganic nutrients.—The significance of the physical state of cell and tissue constituents for their functions.—The ferments, their action and significance.—Hitherto unknown nutrients with specific action.—Problems of total and energy metabolism.—Metabolism of special organs and cells, E. ABDERHALDEN (*Lehrbuch der Physiologischen Chemie.—2. Teil, Die Anorganischen Nahrungsstoffe.—Die Bedeutung des Physikalischen Zustandes der Zell und Gewebsbestandteile für ihre Funktionen.—Die Fermente, ihr Wesen, ihre Wirkung, und ihre Bedeutung.—Bisher unbekannte Nahrungsstoffe mit Spezifischen Wirkungen.—Prob-*

leme des Gesamtstoff und Kraftwechsels.—Stoff und Kraftwechsel Einzelner Organe und Zellen. Berlin and Vienna: Urban & Schwarzenberg, 1921, vol. 2, 4, ed., rev., pp. VIII+723, figs. 38).—This is a revision of the third edition of part 2 of this textbook on physiological chemistry (E. S. R., 34, p. 563). The corresponding revision of part 1 has been previously noted (E. S. R., 44, p. 556).

An aspect of protein metabolism, D. N. PATON (*Brit. Assoc. Adv. Sci. Rpt., 87 (1919), pp. 294–307*).—This presidential lecture, delivered before the Physiology Section of the British Association for the Advancement of Science, deals principally with the question of the significance of creatin in protein metabolism. Evidence is presented from the literature and from hitherto unpublished results from the author's laboratory that the significant part of the creatin molecule is the guanidin nucleus, and that by the formation of creatin free guanidin resulting from the decomposition of the protein is detoxicated and rendered available for synthesis into muscle substance. A list of 32 literature references is appended.

Comparative metabolism of proteins of unlike composition, W. G. KARR (*Jour. Biol. Chem., 45 (1921), No. 2, pp. 289–295*).—To determine whether the proportions of the end products of nitrogenous metabolism in the urine are altered by the type of distribution of nitrogen in the protein intake, metabolism experiments were conducted on dogs using diets varying only in the character of the protein. Casein was selected as an example of a protein with a low content and gluten with a high content of amid nitrogen. These were fed on a high and low protein intake, the remaining calorific requirement being supplied by equal weights of lard and sucrose, with a supplement of 2 gm. of NaCl and 5 gm. of bone ash. Additional experiments were also conducted using dried commercial brewery yeast as the sole source of nitrogen. Urinary analyses were made in the casein and gluten experiments and analyses of both urine and feces in the yeast experiments.

The urinary ammonia output was found not to be influenced to any appreciable extent by the character or quantity of the two proteins. The average excretion on the casein diets was 6.5 per cent and on the gluten diets 5.6 per cent of the total nitrogen. The slight increase on the casein diet is thought to be due to the greater potential acidity of the casein. The creatin found was apparently independent of the nature of the protein and the creatinin evidently of endogenous origin.

The ammonia output in the yeast experiments compared favorably with that of the casein and gluten, giving further evidence that it is not influenced by the character of the protein. The utilization of the yeast nitrogen was about 80 per cent.

Creatin and muscle tonus in man, F. S. HAMMETT (*Jour. Amer. Med. Assoc., 76 (1921), No. 8, pp. 502, 503*).—The author reports a series of analyses of blood from two individuals, first during catatonic stupor and later as the subjects emerged from this condition. In both subjects an absolute and relative increase in creatin occurred with the reestablishment of muscular tone, the increased creatin continuing for some time after the beginning of perceptible muscular movements. These results are thought to support the theory that creatin is an endpoint of the catabolism of that phase of muscle-protein catabolism associated with the condition of muscle tonus.

Gastric analysis.—I, II, M. E. REHFUSS and P. B. HAWK (*Jour. Amer. Med. Assoc., 76 (1921), Nos. 6, pp. 371–373; 9, pp. 564–566*).—Two papers are noted.

I. *Fundamental principles.*—The principal functions of gastric analysis are summarized as the determination of evacuation time or motor activity, the determination of secretory activity and work, and the detection of the presence of pathological products. Factors considered essential to a satisfactory understanding and interpretation of gastric analysis are an absolute conception of normal gastric work, including variations in evacuation and secretion, and of the normal sequence of digestive and interdigestive phases, and a proper standardization of test meals.

II. *The interdigestive phase or the principles governing the phenomena of the resting stomach.*—The authors discuss the characteristics of the normal interdigestive or rest period of gastric analysis on the basis of their previous findings on men (E. S. R., 34, p. 663) and those of Fowler and Zentmire on women (E. S. R., 36, p. 562), together with subsequent observations in the series of studies on gastric response to foods (E. S. R., 44, p. 665).

"The interdigestive period reveals three phenomena: The first motor, in which peristole and tonal and hunger contractions supplant peristalsis; the second, a lessening in secretory velocity and a reduction of the titratable acidity to less than half of that seen in the digestive phase; and the third, an alteration in the status of the stomach and duodenum during this period, which accounts for some of its characteristics.

"In health a satisfactory balance is maintained between the digestive and interdigestive periods. In disease, on the other hand, this balance is ruptured and altered and the interdigestive period may be completely obliterated—a condition comparable to incompetence in other organs of the body."

Some phases of the pathology of nutrition in infancy, W. McK. MARRIOTT (*Amer. Jour. Diseases Children, 20 (1920), No. 6, pp. 461–485*).—In this paper, presented before the Harvey Society of New York on March 27, 1920, the author discusses two types of nutritional disturbances in children, one an acute toxic-like condition usually following severe diarrhea, and the other a chronic state of failing nutrition, known as marasmus. It is shown that the clinical picture in the first condition is due to lack of water and in the other to lack of nourishment. Nutritional methods for the restoration of normal processes in both conditions are discussed.

A study of the urine sugar in infants, R. M. GREENTHAL (*Amer. Jour. Diseases Children, 20 (1920), No 6, pp. 556–561*).—A series of 170 urinary sugar determinations upon 37 infants, normal in the sense of being free from infections or gastroenteric disturbances, is reported. The determinations were made upon 8-hour collections of urine, using the method of Benedict and Osterberg (E. S. R., 39, p. 112) with slight modifications. Both total and nonfermentable sugars were determined, and the fermentable sugars were calculated by difference. Qualitative tests by Benedict's reagent were made on each sample.

The urine in all cases was found to contain a determinable amount of reducing sugar, which was not dependent upon the volume of urine, but was directly proportional to the amount of sugar ingested, the increase being distinctly in the fermentable portion. On a constant sugar intake the excretion of both fermentable and nonfermentable sugars was fairly constant. The extreme variations in total sugar excretion calculated to a 24-hour basis were 100 and 815 mg., the nonfermentable varying from 45 to 253 mg. Considering only the amount of urinary sugar in infants receiving from 6 to 7.5 mg. of sugar, the values for total sugar ranged from 100 to 400 mg. and for the nonfermentable portions from 45 to 150 mg.

It is pointed out that the results obtained in this study in general confirm those of Benedict et al. on the urinary sugar of adults (E. S. R., 39, p. 874), but are in contradiction to the conclusions of Porter and Dunn (E. S. R., 34, p. 258) that there is no direct relationship between the amount of sugar ingested by infants and the presence of sugar in the urine. This discrepancy is thought to be due to the fact that the above authors used qualitative tests only.

The so-called vitamins, B. NEPPI (*Gior. Chim. Indus. ed Appl., 2 (1920), No. 10, pp. 573–580*).—This is a brief and comprehensive discussion of some of the important work on vitamins.

Economy in feeding the family: Why we must have vegetables, E. H. JENKINS (*Connecticut State Sta. Bul. Inform.. 11 (1920), pp. 3*).—In this discussion of the importance of vegetables in the diet, special attention is paid to vitamins.

The effect of yeast on the utilization of food by white mice, R. R. RENSHAW (*Amer. Nat., 55 (1921), No. 636, pp. 73–78*).—In order to eliminate the question of variability of individual animals from the point of view of efficiency as energy transformers in vitamin studies, the author suggests feeding a number of animals a basal diet plus such an amount of vitamin-containing material as to keep the animal in weight equilibrium over a period of time. When this weight equilibruium has been maintained for a number of days and the food consumption noted, the same daily ration should be fed with the exception of a larger vitamin content and the weight noted at the end of the same period of time.

Data from a preliminary experiment conducted on mice according to this scheme are reported. These show that mice which have been brought to approximate weight equilibrium on a diet of casein, starch, lard, butter, salts, and 1 per cent of yeast gain appreciably in weight when kept for approximately the same time on the same ration with 3 or 5 per cent of yeast, the starch and casein being changed to maintain the same calorific value.

A critique of experiments with diets free from fat-soluble vitamin, T. B. OSBORNE and L. B. MENDEL (*Jour. Biol. Chem., 45 (1921), No. 2, pp. 277–288, figs. 5*).—Attention is called to the conflicting results obtained by various investigators as to the effect on young rats of diets supposedly free from vitamin A. In some cases growth continues at a nearly normal rate for periods from 60 to 80 days, while in others no growth is obtained under apparently identical conditions. The conflicting results obtained in the use of lard as the only source of vitamin A are also quoted as illustrative of the general discrepancy of results and as suggestive of the possibility that these discrepancies may be due to failure to completely remove vitamin A from the basal ration.

New data are reported on experiments in which the protein (casein or edestin), the corn starch, and the previously dried brewery yeast used in the basal ration were boiled three successive times with absolute alcohol under a reflux condenser and then filtered off by suction. The diets consisted of extracted protein 18, starch 48, salt mixture 4, and lard 30 per cent, with 0.4 gm. of extracted yeast administered daily apart from this ration.

The growth curves of young rats on this ration as compared with those of animals on the same ration of unextracted materials showed that this treatment caused a reduction of the period of undiminished growth, although in all cases there was limited growth for some time. This is thought to indicate that the extraction may have removed from the food a small amount of vitamin A or other substances which may be of importance for the well-being of the animal.

The authors are of the opinion that, unless the ability of the animals to grow in the supposed absence of vitamin A is due to exceptional vitality of the individuals or to reserve stores of the vitamin in the body, "it seems necessary to conclude, in the light of our experience, that removal of fat-soluble vitamin from even purified proteins and carbohydrates is accomplished with far greater difficulty than has been hitherto suspected."

The effect of certain dietary deficiencies on the suprarenal glands, C. H. KELLEWAY (*Proc. Roy. Soc. [London], Ser. B, 92 (1921), No. B 642, pp. 6–27, pl.*

1, fig. 1).—The studies reported in this paper consist essentially in an investigation of various points brought out in the observations of McCarrison on the enlargement of the adrenal glands with increase in their content of adrenalin in pigeons suffering from polyneuritis on a polished rice diet (E. S. R., 44, p. 262).

Preliminary observations on normal pigeons which had been kept caged for varying periods showed a progressive increase in the weight of adrenalin per kilogram of body weight with prolonged captivity. While it has not been proved how far this was due to lack of exercise and how far to seasonal variation, the data are thought to indicate the necessity of using as controls, in any study of the effect of diet on the adrenals, birds kept on normal diet for the same period under identical conditions.

The experimental data reported include observations on pigeons fed with polished rice alone and with the addition of Marmite, olive oil, cod liver oil, and casein extracted with ether and absolute alcohol, the weight of adrenals and content of adrenalin being compared in each case with that of normal birds kept under the same conditions. These data confirm McCarrison's observations on the occurrence of enlargement of the adrenals with increased store of adrenalin in pigeons fed on polished rice, and show the same to be true of those fed on polished rice plus either protein or fat. The changes were prevented by the addition of an adequate ration of yeast extract. The addition of yeast extract to a basic diet of polished rice with extra fat or protein did not prevent an increase in the store of adrenalin but did prevent the enlargement of the glands.

In an effort to explain the enlargement of the adrenals, the theory that it was the result of inanition and due to the storage in the adrenal cortex of lipoids which had been set free by the breaking down of body tissues was tested by determinations of the cholesterol content of the adrenals and blood of polyneuritic pigeons and of pigeons and rabbits fed on a normal diet with the addition of cholesterol. In pigeons with extreme symptoms of polyneuritis an increase in the percentage of cholesterol in the blood was noted, but no evidence of storage in the adrenals. The production of hypercholesteremia in normal rabbits and pigeons resulted in a small increase in the content of adrenalin in the adrenals.

"The increased content of adrenalin in the adrenals of birds on deficient diets is attributed to diminished output of adrenalin as a result of lowered body metabolism. The edema which occurs in some cases of experimental polyneuritis is not due to increased output of adrenalin. Daily administration of adrenalin to birds fed on normal or polished rice does not cause edema, nor does it accelerate or retard the onset of polyneuritis in pigeons on a polished rice diet."

Report on an outbreak of pellagra amongst Armenian refugees, 1916–17 [Food in relation to pellagra], R. G. WHITE (*Egypt Dept. Pub. Health, Rpts. and Notes Pub. Health Labs., No. 2 (1919), pp. 46, pls. 11, fig. 1*).—The history of the refugees and of the outbreak is given, as well as information on the nature of food and employment, and also details regarding the clinical, experimental, and bacteriological examinations which were made.

The weight of evidence, according to the author, points directly to a faulty diet as a causal factor in the outbreak. Pellagra was eradicated from the camp by correcting the faulty dietary, all other conditions remaining the same. The consumption of maize may have been a factor in the causation of the outbreak, but only as far as it may have been responsible for some deficiency in the diet. "It certainly had no direct causal relation to the disease."

Scurvy: Past and present, A. F. Hess (*Philadelphia and London: J. B. Lippincott Co., 1920, pp. VII+279, pls. 11, figs. 12; rev. in Brit. Med. Jour., No. 3133 (1921), p. 85*).—In this volume, said to be the first treatise on scurvy which has been published in English since the work of Lind in 1772, the author has brought together the recent advances in the knowledge of this nutritional disease, both from the experimental and clinical standpoint. A brief history of the disease, including its occurrence in the various armies and in the civilian populations during the recent war, is followed by chapters on pathogenesis and etiology, the antiscorbutic vitamin, gross and microscopic pathology, experimental scurvy, antiscorbutic foods, symptomatology and diagnosis, prognosis, treatment, metabolism, and the relation of scurvy to other diseases.

The book is illustrated by various charts, micrographs, and radiographs, and an extensive bibliography is appended.

ANIMAL PRODUCTION.

Nitrogen and other losses during the ensiling of corn, R. H. Shaw, P. A. Wright, and E. F. Deysher (*U. S. Dept. Agr. Bul. 953 (1921), pp. 16*).—The authors report data on the composition and nitrogen distribution during two seasons of samples of corn silage taken from bags buried at different levels in a cylindrical concrete silo at the Dairy Division farm at Beltsville, Md.

There was in general a perceptible loss of nitrogen from the bags, due mainly to the escape of albuminoid nitrogen in the juice. There was also a considerable decrease in the crude fiber and in the furfural-yielding bodies, while the reducing and nonreducing sugars almost entirely disappeared. It is estimated that the loss of nitrogen in the 2,579 lbs. of juice collected during the first year represented the protein in about 1,500 lbs. of average silage, while in the second year, when the amount of juice (9,494.5 lbs.) was much greater, due to the relative immaturity of the corn, the loss was equivalent to the protein in 7,500 lbs. of silage.

There is a bibliography of 19 titles.

Analysis of Russian thistle hay (*North Dakota Sta. Bul. 146 (1921), p. 5*).—Russian thistle hay was found to have the following percentage composition: Moisture 6.5, crude protein 12.5, ether extract 3.3, crude fiber 22.3, nitrogen-free extract 39.9, and ash 15.5. A mineral analysis is also given. The cathartic properties of the hay are attributed to potassium chlorid.

Commercial feeding stuffs, E. G. Proulx et al. (*Indiana Sta. Bul. 252 (1921), pp. 15*).—This bulletin consists of suggestions for users of commercial feeding stuffs, tabulated average analyses, notes on the consumption of various classes of feeds in Indiana, and statements of some of the provisions of the State Feeding Stuffs Control Law.

A study of the distribution of iodin between cells and colloid in the thyroid gland.—I, Methods and results of study of beef, sheep, and pig thyroid glands, A. L. Tatum (*Jour. Biol. Chem., 42 (1920), No. 1, pp. 47–53*).—Colloid-free thyroid tissue was secured by washing frozen sections of the fresh gland in Ringer's solution, sections being cut sufficiently thin to open all acini. The cell mass contained appreciable amounts of iodin but the percentage varied considerably, although the ratio of this percentage to the percentage in the whole gland is considered fairly constant. Two pig, 9 sheep, and 18 ox thyroids were used in the investigation.

Effect of feeding the pineal body upon the development of the albino rat, W. R. Sisson and J. M. T. Finney (*Jour. Expt. Med., 21 (1920), No. 3, pp. 335–346 pl. 1 figs. 5*).—Experiments are reported which show that the feeding of desiccated pineal body of young calves was without effect upon the development of young albino rats, being without influence on the body dimensions and weights of the thymus and testes.

Initiative in evolution, W. A. KIDD (*London: H. F. & G. Witherby, 1920, pp. X+262, figs. 80*).—The author assembles as evidence in favor of his well-known theory of use-inheritance a variety of information as to the distribution and direction of the hair on the bodies of domestic animals and man, and reports observations on the influence of harness on the hair of horses.

Fat cattle prices and pure-bred values, E. N. WENTWORTH (*Breeder's Gaz., 79 (1921), No. 21, p. 947, fig. 1*).—The author has studied the sales records of pure-bred Shorthorn, Hereford, and Aberdeen-Angus cattle during the years 1900 to 1920. The prices received averaged about three times the current values of native steers of comparable quality sold on the Chicago market. From 1900 to 1903 and from 1916 to 1920 the pure-bred cattle were relatively more valuable, but during the intermediate period they were less valuable.

Live stock investigations for the year 1920–21, C. W. MCCAMPBELL (*Kansas Sta., Fort Hays Substa. [Pamphlet], 1921, pp. 3–8*).—This publication was designed for distribution during the cattlemen's "round-up" at the Fort Hays Substation in April, 1921, and reports experiments with cattle and sheep designed particularly to show the value of wheat straw in the winter ration.

In a 120-day experiment with 6 lots of 10 mature cows just off the range with suckling calves at side, the lot fed wheat straw exclusively (25.5 lbs. per head daily) lost on an average of 0.02 lb. per cow per day, while the lot fed sorghum silage exclusively (42.5 lbs. per head daily) lost 0.23 lb. The replacement of 12.5 lbs. of silage by 2 lbs. of cottonseed cake produced a gain of 0.013 lb. The addition of 2 lbs. of cottonseed cake to the straw ration caused a daily gain of 0.5 lb. The combination of 20 lbs. of straw and 30 lbs. of silage produced a daily gain of 0.37 lb., while 15 lbs. of straw, 30 lbs. of silage, and 2 lbs. of cottonseed cake produced a gain of 1.08 lbs.

In a 120-day experiment with 2 lots of 20 375-lb. steers each, it was found that a ration of 11.73 lbs. of wheat straw and 1 lb. of cottonseed cake produced a daily gain of 0.58 lb., while a ration of 21.25 lbs. of sorghum silage and 1 lb. of cottonseed cake produced a daily gain of 0.5 lb. The gains of these lots during the summer and the following winter will be reported later.

In a 100-day test with 59 70-lb. lambs divided into 2 lots, it was found that a ration of 2 lbs. of sorghum silage, 0.66 lb. of wheat straw, and 0.125 lb. of cottonseed meal resulted in a loss in weight averaging 0.052 lb. per head daily. When 0.25 lb. of ground kafir was added to essentially the same ration there was a slight gain, averaging 0.035 lb. Neither ration is considered satisfactory.

In a 100-day test with 175 mature ewes divided into 2 groups, it was found that a ration composed of wheat straw and cottonseed meal, the latter replaced by ground kafir and bran during the last 40 days, resulted in a loss in weight, but the addition of cane silage to such a ration produced a slight gain. These sheep showed decided lack of thriftiness which disappeared when cottonseed meal was dropped from the ration and replaced by kafir and bran. A similar improvement was noted, however, in a subgroup of the silage-fed lot in which kafir and bran were fed in conjunction with cottonseed meal.

Use of feed experiments, C. R. MOULTON, W. S. RITCHIE, and L. D. HAIGH (*Missouri Sta. Bul. 179 (1921), pp. 11–13, figs. 4*).—Charts are presented showing the growth in weight, height, girth, and length that may be expected of beef animals from birth to four years of age when fed full, medium, and poor rations, respectively.

[Cattle feeding experiments at the North Dakota Station] (*North Dakota Sta. Bul. 146 (1921), pp. 20, 21, 28–34*).—A continuation of the grazing and nutrition experiments noted from Bulletin 136 (E. S. R., 43, p. 374) is reported.

In the fourth year (1919) of the pasture test of native range grasses, steers given 3 acres per head exhausted the pasture in 90 days, while steers given 5, 7, or 10 acres per head were carried throughout the season of 140 days. The average of the 4 years shows that the maximum gains per steer were secured with 7 acres to a steer and the maximum gains per acre with 3 to the steer.

In two repetitions of the comparison between high and low protein rations of equal energy, one made with 700-lb. yearling steers and the other with calves, no marked or consistent differences in gains or economy of gain were observed betwen the groups fed the two rations.

The cut-over pine lands of the South for beef-cattle production, F. W. Farley and S. W. Greene (*U. S. Dept. Agr. Bul. 827 (1921), pp. 51, figs. 13*).—This is a survey of the cattle industry in the Coastal Plain region of the southeastern part of the United States, and the possibilities of the cut-over lands for beef production. Discussions of climate, soils, land ownership, pastures, feeding of cattle, buildings and shelter, diseases, water supply, and markets are included.

The improvement of the native pastures is considered the most important problem facing the beef producer in this region, and it is recommended that the main emphasis be placed upon the spread and protection of carpet grass and lespedeza. For winter feeding corn stover, legume hays, cottonseed hulls, and corn silage are the principal roughages recommended, while for concentrates the main reliance is placed upon velvet beans.

A brief report is made of a feeding experiment conducted in collaboration with the Mississippi Experiment Station showing that essentially the same gains and economy of gain were secured whether the velvet beans and pods were crushed or not. The steers, however, seemed to relish the whole beans better than the crushed beans.

Heavy and light grain rations when fed in connection with corn silage and clover hay for fattening steers, E. A. Trowbridge (*Missouri Sta. Bul. 179 (1921), pp. 15, 16, fig. 1*).—Results of a 120-day feeding experiment with 5 lots of 8 900-lb. steers are tabulated. The standard ration consisted of corn, linseed cake, alfalfa hay, and corn silage and resulted in a daily gain of 2.85 lbs. per head. When this was modified by feeding the corn during the last 60 days only, the daily gain was 2.39 lbs. The gain was 2.14 lbs. when no concentrates were fed during the first 60 days, 2.12 lbs. when corn was entirely omitted but with cake fed throughout, and 1.99 lbs. when the corn was omitted and the cake fed during the last 60 days only.

Barley v. corn for fattening steers (*Wisconsin Sta. Bul. 323 (1920), pp. 12, 13*).—In an experiment by J. G. Fuller, F. B. Morrison, and J. M. Fargo a lot of 10 steers fed crushed barley, cottonseed meal, corn silage, and mixed hay for 126 days gained 2.45 lbs. per head daily, while a similar lot fed shelled corn in place of barley and an increased proportion of cottonseed meal gained 2.03 lbs. The barley lot shrank more in shipment but sold for 15 cts. more per 100 lbs. "Considering all the factors, crushed barley in this trial was worth fully as much per ton as shelled corn for beef production."

Nutrition of heifers—raising calves on milk substitutes, A. C. Ragsdale and C. W. Turner (*Missouri Sta. Bul. 179 (1921), p. 22*).—Two lots of calves were taken off skim milk at the age of 60 days. The lot fed soy bean hay and a mixture of corn chop, bran, and linseed meal (4:1:1) made 71 per cent of the normal gains in weight and 70 per cent of the normal gains in height. The lot fed alfalfa hay and a similar grain mixture in which soy bean replaced linseed meal made less than 40 per cent of the normal gains in weight and 45 per cent of the normal gains in height. The differences are attributed largely to the fact that the second lot would not eat large quantities of the hay.

Sunflower silage for sheep, H. Hackedorn (*Washington Sta. Bul. 158 (1920), pp. 11, 12*).—From a study of the composition of sunflower silage and its digestibility by sheep, it was found that 100 lbs. of the silage contained 1.72 lbs. crude protein, 1.76 lbs. ether extract, 6.42 lbs. crude fiber, and 9.96 lbs. nitrogen-free extract, of which 1, 1.45, 2.5, and 5.67 lbs., respectively, were digested.

Two lots of 5 lambs each were fed barley, cull beans, pea straw, and corn or sunflower silage. The lot fed corn silage required 4.4 lbs. of grain, 1.9 lbs. of pea straw, and 5.3 lbs. of silage per pound of gain, while the lot fed sunflower silage required 6.7 lbs. of grain, 3.1 lbs. of straw, and 8.1 lbs. of silage. The length of the feeding period is not stated.

Utilization experiments with poppy seed cake and walnut cake, F. Honcamp, H. Zimmermann, and E. Blanck (*Landw. Vers. Sta., 93 (1919), No. 1–2, pp. 77–90, pls. 2*).—Digestion trials are reported in which oil cake from two varieties of poppy seed and decorticated and undecorticated walnut cake were fed to two sheep during 10-day periods in conjunction with meadow hay. The composition of the cakes and the average of the digestion coefficients for the two sheep follow:

Composition and digestibility of poppy seed cake and walnut cake.

Kind of oil cake fed.	Composition (dry basis).					Digestibility (sheep).				
	Crude protein.	Ether extract.	Crude fiber.	N-free extract.	Ash.	Organic matter.	Crude protein.	Ether extract.	Crude fiber.	N-free extract.
Poppy seed:	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
Brown	35.14	5.80	15.43	27.52	16.11	68.6	81.6	99.5	40.9	60.3
White	44.40	8.10	10.18	27.09	10.23	85.8	90.9	89.1	91.0	72.0
Walnut:										
Undecorticated	23.22	8.96	30.90	31.95	4.97	53.5	83.8	97.5	14.5	58.9
Decorticated	45.81	9.55	6.76	32.12	5.76	88.8	91.2	97.9	36.9	94.7

The brown poppy seed cake was made from a crop raised in Asia Minor and the white cake came from East India poppies.

[Lamb feeding experiments at the Wisconsin Station] (*Wisconsin Sta. Bul. 323 (1920), pp. 13, 15*).—In three trials by F. B. Morrison and F. Kleinheinz lambs fed in a well ventilated barn averaged a daily gain of 0.395 lb. per head, while lambs in an open shed partially boarded up averaged 0.386 lb. The latter lambs required 2.5 per cent more concentrates, 10.8 per cent more hay, and 1.9 per cent more silage per unit gain.

In other experiments it was found that cottonseed meal is fully equal in value to linseed meal for fattening lambs. Gluten feed, when fed in large enough amounts to balance the ration, produced as rapid gains as linseed meal but not as high a finish.

Beet by-products for fattening lambs, E. J. Maynard (*Colorado Sta. Bul. 266 (1921), pp. 12, figs. 4*).—This is a report of a 93-day feeding trial, begun November 28, 1920, and involving 8 lots of 32 lambs each. The following table summarizes the methods of feeding and the main results.

Use of beet molasses and molasses beet pulp in a 93-day lamb feeding test.

Lot.	Beet product fed.	Grain fed.	Initial weight per lamb.	Daily ration.			Daily gain per lamb.	Feed per pound of gain.			Dressed weight.
				Beet product.	Grain.	Alfalfa hay.		Beet product.	Grain.	Alfafa hay.	
			Lbs.	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Per ct.*
1	None	Corn	70.7	......	1.03	2.50	0.334	......	3.09	7.49	50.6
2	Molasses	do	71.0	0.30	.76	2.53	.347	0.86	2.20	7.26	50.4
3	do	Barley	71.1	.30	.76	2.54	.314	.95	2.43	8.08	49.7
4	do	Oats	71.1	.30	.76	2.61	.323	.92	2.36	8.09	49.0
5	Dried pulp	None	71.2	1.03	....	2.45	.314	3.28	....	7.81	49.0
6	do	Corn	70.8	.52	.52	2.50	.351	1.48	1.47	7.12	51.3
7	do	do	70.9	.34	.69	2.67	.338	1.02	2.04	7.91	50.5
8	Wet pulp	do	71.3	5.56	.52	2.17	.367	15.14	1.41	5.92	51.8

It is stated that beet molasses formed 25 per cent of the dry matter in the molasses beet pulp. The wet pulp had an average moisture content of 88 per cent, the dry pulp 11.4 per cent. Proximate analyses, made by E. L. Scott, of the feeds offered are tabulated.

Lot 1 showed the least shrinkage and lot 5 the greatest. The feeding of the dried beet pulp did not increase the labor cost over the straight grain ration. Molasses feeding increased the labor cost slightly, while the use of wet pulp more than doubled it.

Variation in farrow, with special reference to the birth weight of pigs, W. J. CARMICHAEL and J. B. RICE (*Illinois Sta. Bul. 226, abs.* (*1920*), *p. 4*).—The complete bulletin has been noted (E. S. R., 43, p. 571).

Growing hogs in Georgia, R. M. GRIDLEY and P. TABOR (*Ga. Col. Agr. Bul. 223* (*1920*), *pp. 36, figs. 16*).—This general discussion includes information concerning hog pastures in the southern part of the United States.

Study of comparative value of protein supplements in swine rations, H. HACKEDORN (*Washington Sta. Bul. 158* (*1920*), *pp. 12, 13*).—In an experiment with 45-lb. pigs, 4 lots were fed barley and shorts (3:1) and a protein supplement until they reached a market weight of 225 or 250 lbs. The nutritive ratios were widened as the experiment progressed but were kept uniform from ration to ration. The supplements fed and the amounts of feed required per pound of gain were as follows: Linseed meal, 3.34 lbs.; fish meal, 3.39 lbs.; tankage, 4.03 lbs.; and coconut meal, 4.4 lbs. The coconut meal ration was found to be too bulky with the high proportion of coconut meal used.

In a grazing experiment in which hogs on pasture were compared with others in the dry lot, it was found that an acre of alfalfa pasture in 44 days saved 877 lbs. of grain and an acre of pea forage in 60 days saved 680 lbs. of grain. In a hogging-off experiment 15 94-lb. pigs, on an acre of corn yielding 36.7 bu. per acre, produced 487.5 lbs. of pork in 30 days.

[**Hog feeding tests at the Edgeley Substation**], O. A. THOMPSON (*North Dakota Sta. Bul. 145* (*1921*), *pp. 24–26*).—Data collected during three years are tabulated, showing the gains of a group of hogs which were turned on to Canada field peas in August and then allowed to hog-off a field of white flint corn. A brief test in feeding pigs with ground barley in a self-feeder is also noted.

[**Hog feeding experiments at the Wisconsin Station**] (*Wisconsin Sta. Bul. 323* (*1920*), *pp. 8–12, figs. 2*).—Continuation of experiments with whey as a supplement to grain in hog feeding (E. S. R., 44, p. 268) is reported. Younger pigs were employed in the new experiments, which were conducted by F. B. Morrison, G. Bohstedt, and J. M. Fargo, and it was found that whey did not provide enough protein for maximum growth when fed alone with barley or corn, but that a small amount of tankage or linseed meal corrected this deficiency. Experiments also showed that middlings and linseed meal are satisfactory protein supplements to corn or barley only when the hogs have access to pasture. In the dry lot the addition of skim milk or tankage to such a ration greatly increased the rapidity and economy of gain. A mixture of linseed meal and tankage was found more satisfactory than tankage alone as a supplement to corn, both on pasture and in the dry lot.

Experiments were made by Morrison and Bohstedt to test the practical importance of Steenbock's discovery (E. S. R., 42, p. 461) that vitamin A tends to be associated with yellow pigment. Pigs fed yellow corn and tankage gained 1.59 lbs. per head daily, while pigs fed white corn and tankage gained only 1.13 lbs. and required 16 per cent more feed per unit gain. Orange-colored carrots added to a ration of white corn, linseed meal, and ground rock phosphate increased the gain, but sugar beets, which are known to be low in vitamin A, did not improve such a ration. There were no differences between yellow and white corn when there were other sources of vitamin A such as rape pasture or legume hay. Because of deficiencies not connected with vitamin content a ration of yellow corn and linseed meal was not satisfactory in the dry lot even when the lime content was increased by the addition of rock phosphate.

Some notes on perennial and annual pasture crops are included. Biennial sweet clover in a 2-year test proved inferior to alfalfa and to red clover.

Forages for swine, W. L. Robison (*Ohio Sta. Mo. Bul., 6 (1921), No. 3-4, pp. 46-50, fig. 1*).—This article consists mainly of excerpts from the section of Ohio Station Bulletin 343 (E. S. R., 44, p. 471) dealing with the comparison of forage crops. In particular experiments 14, 15, and 17 of the bulletin are reviewed.

Hogging down corn and soy beans, L. A. Weaver (*Missouri Sta. Bul. 179 (1921), pp. 16, 17*).—In a study of hogging down a field of corn in which soy beans had been sown at the final cultivation, it was found that the soy beans did not entirely take the place of a protein supplement (tankage).

Feeding trials with debittered lupines for fattening hogs, Müller (*Mitt. Ver. Deut. Schweinezüchter, 28 (1921), No. 4, pp. 73-77*).—A lot of 8 hogs fed a ration of debittered lupines, potatoes, and mangels (3 : 16 : 16) made an average daily gain of 0.62 kg. per head during the 8 weeks of the test. Two other lots fed rations containing, respectively, 50 and 100 per cent more lupines made less gain but consumed less feed. The gains tended to be proportional to the total feed consumption and not to the lupine content of the ration.

[Field peas for hogs at the Idaho Station] (*Idaho Sta. Bul. 122 (1921), pp. 26, 27*).—In a hogging off test during the summer of 1920, 6 fall pigs weighing 1,091 lbs. were turned on an acre of field peas having an estimated yield of 22 bu. per acre. They received a 1 per cent barley ration and in 35 days gained 344 lbs. A lot of 8 pigs weighing 1,656 lbs. and receiving a 2 per cent barley ration while on an acre of peas yielding about 20 bu. per acre gained 500 lbs. In the same period a lot of 13 spring pigs were kept on a 2-acre plat of peas, but received no grain ration. The initial weight per acre was 751.5 lbs. and the gain per acre 245.5 lbs.

In 2 experiments with rolled barley and cracked peas for fattening 150-lb. hogs, it was found that a 3 : 1 mixture produced more rapid and more economical gains than a 1 : 1 mixture and was definitely superior to a 1 : 3 mixture. The addition of tankage to the extent of 5 per cent of the grain mixture improved the gains in each case.

Soft pork studies, II, J. M. Scott (*Florida Sta. Bul. 160 (1921), p. 45-52, fig. 1*).—This is a report of a more extensive trial than that noted from Bulletin

157 (E. S. R., 43, p. 775) of the author's puncture method of studying the melting point of the fat of hogs during the progress of a feeding experiment.

Beginning August 23, 1920, 2 lots of Berkshires (6 sows and 4 barrows to a lot) were fed during two 44-day periods. The pigs had been raised on the station farm and had been fed uniformly on a light ration of corn and shorts, with access to Bermuda-grass pasture. The initial melting points of the fat ranged from 27.9 to 32.8° C. in lot 1 and from 26.6 to 33.1° in lot 2.

In the first period the lot 1 pigs were fed peanuts exclusively. By the end of the period the melting point of the fat of 9 individuals had declined, the decrease varying from 2.4 to 7.2°. The hog with the lowest initial melting point showed an increase of 0.5°. During the second period these hogs were fed corn, shorts, and cottonseed meal (4:5:1). For all of the 8 hogs of which there were records there was an increase in the melting point varying from 0.7 to 8.5°.

Lot 2 were fed corn, shorts, and cottonseed meal during the first period. In the case of 8 pigs there was an increase in the melting point ranging from 0.9 to 4.5°. The two animals with the highest initial melting points showed a decrease of 0.6 and 1.3°, respectively. During the second period lot 2 were fed peanuts alone. In 5 cases the melting point declined and in 5 cases it increased over the first period. The greatest decrease was shown by the pig with the highest melting point at the end of period one, and the greatest increases were shown by the 2 pigs having the lowest melting point at that time.

The change in the fat of peanut-fed rabbits, S. T. DOWELL (*Science, n. ser., 53 (1921), No. 1377, p. 487*).—In connection with the soft pork investigations at the Oklahoma Experiment Station, 4 rabbits were fed peanuts and alfalfa for 6 weeks. One was killed at the end of the feeding period and the others after a fast of 3, 5, and 7 days, respectively. It was found that starvation caused a progressive decrease in the iodin number of the back fat (from 96 to 66) and the kidney fat (from 98 to 92), but the liver fat, which increased in amount as was expected, did not change its iodin number. It is concluded that the animals utilized the softer fats for body maintenance during fasting.

[Horse feeding results at the Missouri Station], E. A. TROWBRIDGE and D. W. CHITTENDEN (*Missouri Sta. Bul. 179 (1921), pp. 17, 18, figs. 2*).—Seven Percheron foals made an average daily gain of 1.51 lbs. per head from September 26, 1919, until they were put on pasture May 1, 1920. The ration averaged 6.75 lbs. of a grain mixture (oats, corn, and bran, 2:2:1) and 7.47 lbs. of choice alfalfa hay.

During 6 weeks in January and February, 1920, 6 mares not working were fed 15 lbs. of silage per head daily which they ate readily. The silage was fed in the evening, oat straw being given in the morning. The grain ration averaged 9.5 lbs. and the mares gained 15 lbs. per head during the feeding period.

Poultry as an economical producer of food, A. R. LEE (*Jour. Amer. Assoc. Instr. and Invest. Poultry Husb., 7 (1921), No 4, pp. 31, 32*).—At the Beltsville, Md., Experiment Farm of the U. S. Department of Agriculture Leghorn pullets consumed 4.8 lbs. of feed per dozen eggs and Leghorn yearlings 5.5 lbs. General purpose fowls as pullets consumed 6.7 lbs. and as yearlings 9.6 lbs. Extensive data on the cost of fattening chickens secured from commercial concerns by the Bureau of Animal Industry showed that 3.26 lbs. of grain and about 1.5 times this amount of buttermilk were required per pound of gain.

These results are compared with published data on the feed consumption per productive unit of other classes of live stock, and are held to show that poultry outrank steers and sheep in their ability to convert farm crops into human food.

[Poultry feeding at the Missouri Station], H. L. KEMPSTER (*Missouri Sta. Bul. 179 (1921), pp. 43, 44*).—Studies on protein supplements (E. S. R., 43, p.

776) have been continued. In the pens receiving meat scrap, it is stated, the egg production was proportional to the amounts fed. As in earlier experiments, cottonseed meal proved distinctly inferior to meat scrap for egg production.

Eight lots of White Leghorn chicks were used in a study of the influence of supplementary feeds on growth. The greatest growth and lowest mortality during the first six weeks occurred in the pen fed both skim milk and egg yolk. The least growth and highest mortality occurred in the pens fed either white of eggs and bone meal or tankage and green food. Intermediate growth occurred when either whole milk, skim milk, whole eggs, or skim milk and green feed were given.

It is stated that second-generation chicks are being raised in the experiments in which chickens are being fed materials free from plant carotinoids (E. S. R., 44, p. 69). The chicks at the age of 12 weeks were normal except for the absence of the yellow pigmentation. The growth is described as excellent and the mortality was very low.

Cost of raising Leghorn chicks (*Idaho Sta. Bul. 122* (*1921*), *p. 46*).—Data are presented showing the amount of fuel, feed, and labor required to raise 250 Leghorn chicks to the age of 12 weeks and 118 pullets from the twelfth to the twenty-fourth week.

Some problems of fox farming, J. A. Allen (*Sci. Agr.*, *1* (*1921*), *No. 4*, *pp. 159–162*, *figs. 4*).—The author presents brief notes on the management of foxes, with particular reference to sanitation, feeding, breeding, registration, and the standardization of type. The article is based upon the experiences of the Fox Research Station, Charlottetown, P. E. I.

DAIRY FARMING—DAIRYING.

Comparison of feeding standards for dairy cows (*Wisconsin Sta. Bul. 323* (*1920*), *pp. 7, 8*, *fig. 1*).—An experiment involving 16 cows divided into 2 groups and fed by the double reversal method during three 5-week periods was conducted by F. B. Morrison, G. C. Humphrey, and F. L. Putney for the purpose of comparing a ration balanced according to the Savage standard with one made up by the Armsby standard, the proportion of digestible protein in each case being the same. During feeding by the Armsby standard an average ration of 7.21 lbs. of concentrates, 10.8 lbs. of alfalfa hay, and 31.6 lbs. of corn silage was fed and the daily yield averaged 25.72 lbs. of milk and 0.97 lb. of butter fat. The Savage standard called for an increase in the concentrates and silage to 10.33 and 32.3 lbs., respectively, and on this ration 2.22 lbs. more milk and 0.07 lb. more fat were produced per day per cow.

Further contributions to the physiology of phosphorus and calcium metabolism of dairy cows, E. B. Meigs, N. R. Blatherwick, and C. A. Cary (*Jour. Biol. Chem.*, *40* (*1919*), *No. 2*, *pp. 469–500*).—In continuing their work in the Dairy Division, U. S. Department of Agriculture, previously noted (E. S. R., 41, p. 678), the authors, working in collaboration with T. E. Woodward, found that the phosphorus assimilation of dry dairy cows could be increased by a system which reduced the disturbing influence of calcium in the intestines. This result was secured by feeding a double ration of the phosphorus-rich grain ration (corn-and-cob meal, wheat bran, and cottonseed meal, 5:4:2, with or without disodium phosphate) one day without roughage and feeding a double ration of the calcium-rich roughage (alfalfa hay and corn silage) the following day without grain.

So far as could be judged by the data collected during balance experiments, the calcium assimilation was abnormally low, although the cows showed no indication of calcium privation and carried fetuses with well-formed skeletons. Examination of the published records of 136 mineral balance experiments with cattle, sheep, and pigs showed that in practically every case the ratio of calcium assimilated to phosphorus assimilated was distinctly less than the characteristic ratio of calcium to phosphorus in the skeletons of animals at slaughter. The data compiled by Forbes and Keith (E. S. R., 32, p. 858) show that the latter ratio is quite constantly 1.9 in the case of mature ruminants and 1.6 in the case of swine. The authors argue that if the observed ratios of assimilated calcium and phosphorus in balance experiments represent the actual condition the animals could not have produced skeletons of normal composition, and they conclude that the necessary disturbances to an animal incident to the collection of feces and urine in a balance experiment cause profound disturbances in calcium metabolism.

The feeding of inorganic phosphate was found to increase the phosphorus content of the blood plasma. The relation between the concentrations of plasma phosphorus and urinary phosphorus was not so pronounced, due it is thought to differences in the acid-base equilibrium. There was an inverse relation between the amounts of calcium and phosphorus excreted in the urine, but this relation seemed easily disturbed by other influences, particularly the ratio of acids and bases in the ration.

The influence of calcium and phosphorus in the feed on the milk yield of dairy cows, E. B. Meigs and T. E. Woodward (*U. S. Dept. Agr. Bul. 945* (*1921*), *pp. 28, figs. 3*).—This is mainly a study of the influence of the "alternate feeding with phosphate" procedure (noted above) on the subsequent milk yields of the cows. There were 21 cows of the general herd at Beltsville that were fed the experimental rations during a 2-months' dry period preceding a lactation. The indications were that the milk yields were higher than was expected from previous experience with the herd. For 7 of the cows there was a more complete control in that milk records were available following dry periods in which only the ordinary feeding methods were used. Between the tenth and fortieth days after freshening these 7 cows gave a total of 5,081 lbs. of milk following ordinary feeding and 6,885 lbs. following the alternate rations with disodium phosphate. If the alternate feeding had had no influence on milk secretion, it is estimated that the latter total would have been 4,993 lbs. This figure is based upon the yields after the control feeding, with suitable corrections for age differences and the fact that some of the animals aborted.

The cows in the general herd were fed both during the control and the experimental feeding substantially according to the Savage standard. Cows on 365-day advanced registry tests did not respond noticeably to the alternate-phosphate feeding, but these cows received heavy rations when dry and in the course of the year (including the dry period) they received about 100 per cent more protein and 50 per cent more total nutrients than the Savage standard calls for. The method of feeding on test thus seemed to supply all the phosphorus needs of the cows.

The dosage of phosphorus as $Na_2HPO_4.12\ H_2O$ varied from 4.5 to 24 gm. per day and caused no digestive disturbances.

The influence of calcium and phosphorus in the feed on the milk yield of dairy cows, E. B. Meigs and T. E. Woodward (*Jour. Dairy Sci., 4* (*1921*), *No 3, pp. 185–217, figs. 3*).—Barring minor verbal changes and rearrangement of tables, this paper is identical with the bulletin noted above.

Sunflower silage for dairy cows, G. E. Morton (*Colorado Sta. Rpt. 1920, pp. 19*).—In a briefly reported experiment, cows during a period of feeding on sunflower silage produced 86 per cent of the butter fat and 91 per cent of the milk which they produced during a period of corn silage feeding. Having regard to the increased tonnage per acre, the result is considered not unfavorable to the sunflower silage.

Sunflower silage experience in northern Michigan, D. L. McMillan (*Hoard's Dairyman, 61 (1921), No. 21, pp. 850, 868, fig. 1*).—At the Upper Peninsula Substation sunflower silage was fed to the dairy herd. Change to oat-and-pea silage did not affect production, but when the feeding of sunflower silage was resumed the milk yield declined, due at least in part to advance in lactation. Owing to its greater bulk only 35 lbs. of the oat-and-pea silage was consumed per head daily, whereas the cows would take 40 lbs. of the sunflower silage readily. The oat-and-pea silage was much more expensive to produce.

Sunflower silage v. corn silage [for milk production], E. G. Woodward (*Washington Sta. Bul. 158 (1920), pp. 18–20*).—Eight cows divided into two groups were fed sunflower silage and corn silage by the reversal method for two periods of 40 days each. While on corn silage the cows gave less milk, gained in weight, and consumed more silage and less grain than on sunflower silage. By making a number of assumptions in regard to the relative values of the feeds and allowances for the changes in weight, it is concluded that the sunflower silage was approximately 92 per cent as valuable as the corn silage.

Hydrolyzed sawdust as a stock food (*Wisconsin Sta. Bul. 323 (1920), p. 5–7, fig. 1*).—Pine sawdust hydrolyzed with dilute acid under pressure by the methods described by Sherrard and Blanco, as noted on page 202, was fed by F. B. Morrison, G. C. Humphrey, and R. S. Hulce to 3 dairy cows during a 4-week period. The concentrate ration consisted of sawdust, barley, bran, and linseed meal (6:8:6:3), with alfalfa hay and corn silage as roughage. It is stated that the cows kept up their production and maintained weight during this period even better than when fed barley, bran, and linseed meal (11:6:3) during the preceding and following periods.

The effect of exercise and feed upon the vitality and breeding ability of bulls, E. G. Woodward (*Washington Sta. Bul. 158 (1920), p. 20*).—Daily exercise of Ayrshire, Jersey, and Holstein herd bulls in a treadmill was found to diminish the time required for service in the case of a slow bull and to increase the motility and longevity of the spermatozoa as determined by microscopic examination of samples of semen collected from the vagina of the cows served.

Unit requirements for producing market milk in southeastern Louisiana, J. B. Bain, G. E. Braun, and W. D. Wood (*U. S. Dept. Agr. Bul. 955 (1921), pp. 15*).—This is a report on the cost of producing milk in Tangipahoa Parish, La., in the two years beginning in March, 1918, and is based upon field studies conducted according to the plan followed in previous investigations of this series (E. S. R., 44, p. 774). Records were obtained from 14 farms for the full two years and from 8 others during one year. The data cover 892.6 cow years and the average production was 3,106 lbs. The milk is sent to New Orleans for consumption as fluid milk. The following table summarizes the average feed and labor requirements for the two years:

Miscellaneous expenditures and amounts of feed and labor expended for milk production in Tangipahoa Parish, La.

Basis of computation and season.	Mill feed.	Home-grown grain.	Legume hay.	Other hay.	Stover and fodder.	Silage, etc.	Human labor.	Horse labor.	Bedding.	Pasture charge.	Miscellaneous costs.[1]
Per cow:	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Hrs.*	*Hrs.*	*Lbs.*		
October to March..	927	22	118	200	185	1,026	75.3	11.6	4	$2.03	$13.05
April to September	939	5	9	9	17	145	89.2.	12.1	......	3.55	11.74
Entire year........	1,866	27	127	209	202	1,171	164.5	23.7	4	5.58	24.79
Per 100 lbs. milk:											
October to March..	70.8	1.6	9.0	15.2	14.1	78.4	5.8	0.9	0.3	.155	.997
April to September	52.2	.3	.5	.5	.9	8.1	5.0	.7	......	.197	.653

[1] Excluding changes in the inventory value of cows.

There were 1,680 lbs. of manure per cow saved in the winter and 1,380 lbs. saved in the summer. About 43 per cent of the cows calved in the winter period and 42 per cent in the summer. There was little demand for the new-born calves so that the credit for calves was low.

Feed and bedding totaled 49.3 per cent of the gross cost (including depreciation), pasture 4.1, labor 24.2, and other costs 18.2. Depreciation of stock formed 4.2 per cent of the gross cost. Credits for manure equaled 5.5 per cent of the gross cost and credit for calves 1.7 per cent.

During the winter 33.1 per cent of the labor was performed by the managers, 41.9 per cent by hired men, and 25 per cent by women and children. In the summer the corresponding percentages were 28.2, 42.7, and 29.1.

To keep a bull for a year required 1,202 lbs. of concentrates, 779 lbs. of dry roughage, 1,126 lbs. of succulent roughage, 4 lbs. of bedding, and 33.6 hours of human labor, besides pasture costs and miscellaneous charges.

Factors affecting the composition of milk, A. C. RAGSDALE and W. W. SWETT (*Missouri Sta. Bul. 179 (1921), pp. 22, 23*).—An experiment is reported briefly which seemed to indicate that a sudden reduction of the total amount of feed to one-half the normal caused an increase in the percentage of fat although the amount of milk fell off. A sudden change in the protein in the ration did not have a marked effect.

The biology of cow's milk.—The alcohol test and the heat test, E. SELIGMANN (*Ztschr. Hyg. u. Infektionskrank., 88 (1919), No. 2, pp. 333–345*).—In a series of experiments the alcohol and heat tests were applied to fresh milk, old milk, soured milk, sour milk neutralized with soda, milk to which small amounts of rennet had been added, and milk containing added calcium chlorid. It is concluded that the tests are better indications of age than of acidity. The ready coagulability of old milk is thought to be due to the development of a "bacterial rennet." The author appears to have been unfamiliar with the work of Ayers and Johnson (E. S. R., 33, p. 113).

The alcohol test as a means of determining quality of milk for condenseries, A. O. DAHLBERG and H. S. GARNER (*U. S. Dept. Agr. Bul. 944 (1921), pp. 13, figs. 3*).—From a study of the alcohol test under commercial conditions at two evaporated milk factories and under experimental conditions at the Grove City Creamery, it is concluded that this test has possibilities as a practical and reliable test for determining the quality of milk for condensing purposes. The acid test was found inadequate for detecting milk with a tendency to coagulate during the condensing process. No direct relation was found between the coagulation of milk with alcohol and its titratable acidity, but milks of high acidity as the result of fermentation tended to coagulate with alcohol.

Streptococci occurring in sour milk, F. S. JONES (*Jour. Expt. Med., 33 (1921), No. 1, pp. 13–24*).—This is a study of the cultural characteristics of *Streptococcus lacticus* in the attempt to differentiate it from mastitis streptococci.

It was found that the rod-like and coccoid organisms arranged in pairs and chains that are encountered in sour milk fall into several groups. The largest number (designated *S. lacticus* I) ferment dextrose, lactose, maltose, mannitol, and salicin, and fail to ferment saccharose, raffinose, and inulin. A smaller number (*S. lacticus* II) differ from these in being able to ferment saccharose. A third type, which is not common, does not attack mannitol. All types grow luxuriantly at room temperature, coagulate milk, reduce litmus, and produce large amounts of acid in fermented bouillon containing dextrose. The mastitis types differ characteristically in these respects and do not survive in milk of high acidity.

No evidence was found from observations and a critical examination of the literature that *S. lacticus* ever occurs in the udder or in fresh milk. The author was not able to identify this organism among numerous strains of streptococci isolated from saliva, feces, the vagina, or the skin of cows, and offers no suggestions as to how it gets into milk.

Elimination of germs from dairy utensils, M. J. PRUCHA and H. A. HARDING (*Illinois Sta. Bul. 230, abs. (1920), pp. 4*).—The complete bulletin has been noted (E. S. R., 44, p. 371).

Should we have a new milk score card? H. A. HARDING (*Jour. Dairy. Sci., 4 (1921), No. 1, pp. 73–77*).—The author claims that the score cards in present use ignore the question of the safety of milk, and suggests a score card in which equal weight (25 points) is given to food value, healthfulness, cleanliness, and keeping quality. Under food value 15 points are allotted to fat and 10 to solids not fat. Under keeping quality, flavor and odor get 15 points, bacteria 5 points, and acidity 5 points. Cleanliness is based entirely upon visible dirt without reference to bottle or cap. Healthfulness, the proposed new division of the score card, is apparently to be based on tuberculin test and pastuerization.

Dairy factory premises and manufacturing processes, L. T. MACINNES and H. H. RANDELL (*N. S. Wales Dept. Agr., Sci. Bul. 20 (1921), pp. 40, figs. 29*).—Previously noted from other sources (E. S. R., 44, p. 372).

Factory butter making, B. VAN DER BURG and S. HEPKEMA (*De Boterbereiding aan de Fabriek. The Hague: Alg. Nederland. Zuivelbond, 1920, 4. ed., rev., pp. VIII+220, figs. 104*).—This is a treatise on commercial butter making, particularly as practiced in whole milk creameries in Holland. Chapters on centrifugal separators, microorganisms in milk, creamery bookkeeping, and milk tests are included.

The estimation of butter fat in cream, H. B. SIEGMUND and R. S. CRAIG (*Jour. Dairy Sci., 4 (1921), No. 1, pp. 32–38*).—The authors find that the Babcock method, as ordinarily employed in cream testing on a commercial scale, gives fat percentages in excess of those given by the Roese-Gottlieb ether extraction method. This is attributed to the inclusion of water or acid in the fat column. When, however, the cream samples were tested with an electrically driven Babcock "supercentrifuge" operated at a speed of 1,600 revolutions per minute, the results were very close to those secured by the extraction method. It is also pointed out that it is difficult to secure accurate results with the ether extraction method when the cream samples are partially churned.

A microscopic method of examining butter for microorganisms, G. L. A. RUEHLE (*Mich. Acad. Sci. Ann. Rpt., 21 (1919), pp. 123–125; abs. in Michigan Sta. Rpt. 1919, pp. 235, 236*).—By the method described 1 gm. of butter is mixed with 1 cc. of hot water in a separator funnel and extracted with 50 or 100 cc. of ether or gasoline. After standing, the aqueous portion, which it was found contains all the bacteria, is drawn off and mixed with an equal volume of sterile sediment-free milk. Smears are then made, and the subsequent procedure is the same as in the Breed method of counting bacteria in milk by means of the microscope.

In 5 samples of butter from pasteurized cream the microscope counts of groups exceeded the plate counts, but in 3 samples of butter made from raw cream and 2 of unknown origin, the plate counts were larger than the microscope counts of groups and in 2 cases larger than the microscope count of individual organisms. Part of this discrepancy is attributed to the failure of some organisms in the smears to take the methylene blue stain.

Statutory standard for ghee, T. K. GHOSE (*Analyst, 45 (1920), No. 537, pp. 444–447*).—The author reports Reichert-Wollny numbers, saponification numbers, and melting points or butyro-refractometer readings of 67 samples of ghee made from milk of individual buffaloes and 166 samples made from mixed milk of several buffaloes. In only one case was the Reichert-Wollny number below 30. The observations were made to determine a standard for buffalo ghee in India, and a minimum Reichert-Wollny number of 28 was taken as a standard to allow for accidental mixture with cow's ghee.

The effect of each ingredient in the manufacture of ice cream, W. H. E. Reid (*Missouri Sta. Bul. 179 (1921), pp. 24, 25*).—Observations on the influence of sugar concentration in the mix on the manufacturing process and the quality of the product are reported.

Increase in the sugar content was found to prolong the time of freezing, the effect being more marked at higher sugar concentrations. Maximum swell was obtained when 12 per cent of sugar was added to the mix; the use of greater or less amounts of sugar decreased the overrun. Increased sugar also reduced the temperature of the finished product, increased the hardness, and reduced the time required to melt under summer conditions.

VETERINARY MEDICINE.

A textbook of pathology, W. G. MacCallum (*Philadelphia and London: W. B. Saunders Co., 1920, 2. ed., rev., pp. XV+1155, pl. 1, figs. 612*).—This is a second edition of a work first published in 1916, which discusses the general principles of pathology as illustrated by the commoner and more important diseases, and is primarily intended for use as a textbook.

Organic medicinal chemicals (synthetic and natural), M. Barrowcliff and F. H. Carr (*London: Baillière, Tindall, & Cox, 1921, pp. XIII+331, figs. 25*).—This volume, which is one of the series of monographs on industrial chemistry edited by S. Rideal, deals with the isolation of natural and the preparation of synthetic organic medicinal chemicals and with their special properties and uses. The various substances thus treated are in general grouped in sections according to their therapeutic uses, including narcotics and general anesthetics, naturally occurring alkaloids and their derivatives, natural and synthetic local anesthetics, antipyretics, and analgesics, organic antiseptics and disinfectants, purgatives, vaso-constrictors, and vaso-dilators, diuretics and uric acid solvents, organo-metallic compounds, the digitalis group, skin irritants, glucosids and neutral principles, and other substances of interest. The last section deals briefly with pituitary and thyroid extracts, thyroxin, vitamins, and saccharin.

Report of the Minnesota State Live Stock Sanitary Board (*Minn. State Live Stock Sanit. Bd. Ann. Rpt., 17 (1920), pp. 25*).—The occurrence of and control work with infectious diseases of live stock during the year are briefly reported upon.

Report of the State board of stock commissioners (*Nev. State Bd. Stock Commrs. Bien. Rpt., 1919–20, pp. 21*).—The occurrence of and control work with diseases of live stock are briefly reported upon.

The preparation of a simplified culture medium for field workers, D. Norris (*Indian Jour. Med. Research, 7 (1920), No 4, pp. 704–709*).—The author has further simplified the culture medium in which meat was replaced by caseinogen (E. S. R., 44, p. 577), by evaporating the neutralized filtrate from the hydrolysis to a thick paste of the consistency and color of Liebig's extract or by further drying it to a powder in a desiccator over H_2SO_4. This paste or powder does not require the addition of either peptone or extractives, but may be made up into a solid nutritive medium by the addition of agar and normal salt solution or water. Similar experiments with ordinary fresh and dried brewery yeast are reported, but the caseinogen is thought to yield a rather better medium.

This medium, to which the name of trypsinoids has been given, is thought to be of particular value for field workers.

Factors influencing anaerobiosis, with special reference to the use of fresh tissue, F. L. Gates and P. K. Olitsky (*Jour. Expt. Med., 33 (1921), No. 1, pp. 51–68, pl. 1*).—An investigation is reported of the part played by the different factors of the tissue method of anaerobic cultivation in the establishment of strictly anaerobic conditions in the culture tube, methylene blue being used as an indicator of the reduction process.

From the experiments reported the authors suggest the following conditions as indispensable for strictly anaerobic culture: "The substitution of solid vaseline for liquid paraffin oil as an oxygen-resisting seal; the use of large pieces of fresh kidney, the standard size to be upward of 0.6 gm. unless other reducing substances are present in the medium; the addition of peptone or dextrose or both in the form of peptone dextrose broth in fractional percentages to nonreducing media such as ascitic fluid or serum to aid in the prompt establishment of anaerobic conditions; the use of the McIntosh and Fildes jar as a further aid to the prompt deoxygenation of the medium; for reasons of economy the use of smaller amounts of culture medium, for example 7 to 8 cc., under a vaseline seal; and in dealing with anaerobes which may be injured by exposure to oxygen it might be advisable to prepare the medium a day or two in advance and to incubate it under a vaseline seal so that sterility is assured and the anaerobic conditions are already established when inoculation is made. The infected material is then introduced with a capillary pipette in the vicinity of the kidney tissue and the seal restored by gentle heating to melt a portion of the superposed vaseline."

The present status of the problems of anaphylaxis, H. G. Wells (*Physiol. Rev., 1 (1921), No. 1, pp. 44–83*).—This review consists of a discussion of the most essential problems of anaphylaxis in the light of the more recent contributions to the literature on the subject.

Infection and vaccination by the tracheal route, A. Besredka (*Ann. Inst. Pasteur, 34 (1920), No. 6, pp. 361–369*).—In this paper the author discusses pulmonary resistance to bacterial invasion and the possibility of increasing this natural local immunity by repeated intratracheal injections of the organism in question. Experiments with rabbits and guinea pigs are cited, showing on the one hand a decreased resistance to paratyphoid virus when injected intratracheally following injection with bile and on the other hand an increased resistance to living diphtheritic bacilli following three intratracheal injections of dead bacilli.

The suggestion is made of the possible application of this method to the increase in the local immunity of the respiratory tract against tuberculosis by repeated injections of massive doses of tubercle bacilli.

Technique of agglutination, W. F. Harvey (*Indian Jour. Med. Research, 7 (1920), No. 4, pp. 671–681*).—Attention is called to the diversity of opinions as to what is to be taken as the titer of an agglutinating serum and to the diversity of methods of carrying out the agglutination test. In the opinion of the author the titer of a serum can best be expressed in terms of the degree of flocculation produced, the comparative turbidity of the suspensions used, and the dilution of the serum. The scheme for recording the titer of a serum in these terms is described, together with a standardized technique for carrying out the agglutination test.

A note on the best method of obtaining precipitating antisera, W. D. Sutherland and G. C. Mitra (*Indian Jour. Med. Research, 7 (1920), No. 4,* *pp. 669, 670*).—As the result of a study of different methods of obtaining precipitating antisera in fowls, the authors recommend the 2-dose method of intravenous inoculation at 3-day intervals, the fowls to be bled the fourteenth day after receiving the last injection of antigen.

Production of high titer sera, W. F. HARVEY (*Indian Jour. Med. Research, 7* (*1920*), *No. 4, pp. 682–700*).—This is a brief discussion of certain points which concern the production of high titer agglutinating sera. These include factors limiting the dosage and frequency of dosage in the production of the sera, methods of recording the titer, differential methods of introducing the antigen, the relative value of living or dead and of dried or undried antigen, factors influencing antibody response, and means of maintaining the titer. The principal conclusions drawn are as follows:

Rabbits yield a serum of higher titer and specificity than goats, but the latter yield much the larger amounts of sera and are more convenient to use. Fowls offer the advantage of being easily procurable and cared for and of yielding a serum of high titer and satisfactory specificity.

Intravenous inoculation of antigen is more efficient than intraperitoneal or subcutaneous. No harm results from frequent repetition of intravenous inoculations in goats or fowls with a 7- or 10-day interval between inoculations. The dose of living organisms that can be administered depends upon the organism. A convenient series of doses for the intravenous inoculation of goats with living organisms is the number corresponding to 1, 2, 3, and 4 mg. of dried bacterial substances. Good sera can be obtained by intravenous inoculation of suspensions of killed organisms, while organisms simply desiccated form a very satisfactory, stable, and efficient antigen. The titer of an agglutinating serum once raised can be easily maintained in goats by subcutaneous inoculations.

Methods of standardizing vaccines, T. P. HASLAM (*Amer. Jour. Vet. Med., 15* (*1920*), *No. 10, pp. 463–466*).—This is a brief comment on various methods of standardizing vaccines. The author is of the opinion that standardization by weight or by comparisons of opacity or turbidity is much more accurate than standardization by bacterial count. The technique employed in opacity comparisons by Brown (E. S. R., 45, p. 177) and that of Dreyer and Gardner, previously noted (E. S. R., 37, p. 14), are briefly described.

Researches on the preparation of antimicrobial and antitoxic sera in the horse, M. NICOLLE, V. FRASEY, E. DEBAINS, and E. NICOLAS (*Ann. Inst. Pasteur, 34* (*1920*), *No. 5, pp. 285–333, figs. 51*).—This is the first report of a series of studies extending over several years of methods of obtaining in the horse specific sera containing, either separately or combined, agglutinating properties for the identification of pathogenic organisms and bactericidal and antitoxic properties for the treatment of microbial diseases.

The paper consists of a description of the general technique employed in methods of immunization and titration of the sera, and a discussion of the results obtained in the preparation and standardization of specific antityphoid, antiparatyphoid, antimeningococcic, antigonococcic, anti-Shiga, anti-Flexner, antimelitensis, anticholera, and antigangrene sera. The results obtained in the standardization of these sera are also indicated in a series of curves prepared by E. Césari.

Studies of chronic intoxications on albino rats.—IV, Fluorid, chlorid, and calcium (including sodium fluorid, sodium chlorid, phosphate rock, calcium phosphate (precipitated), and calcium carbonate (precipitated), T. SOLLMANN, O. H. SCHETTLER, and N. C. WETZEL (*Jour. Pharmacol. and Expt. Ther., 17* (*1921*), *No. 3, pp. 197–225, figs. 19*).—Studies here reported, in which sodium fluorid was administered to rats in their food for continuous periods up to 21 weeks, followed in some cases by after-periods of unpoisoned food, led to the following conclusions:

"Sodium fluorid, eaten with food during long periods in daily doses of 15 to 150 mg. per kilogram of body weight, results in progressive impairment of growth and food consumption. The damage is proportional to the dose. It tends to outlast the administration of the drug, so that the growth of animals that have been poisoned with fluorid remains permanently below that of unpoisoned animals. The diminished food consumption is not due to distaste of the fluorid food, for the animals do not prefer unpoisoned food (except with the highest concentrations).

"The effects are not due to general salt action, for corresponding doses of NaCl are not harmful. Fluorid in the form of phosphate rock produces the same effects as NaF, and in nearly corresponding doses. The deleterious effect of phosphate rock is not shared by other insoluble Ca salts (phosphate and carbonate) in equal concentration. No deleterious effects on growth or food consumption occurred in nine weeks with daily doses of NaF of 8 mg. per kilogram of body weight, or with smaller doses."

[Forage poisoning], Z. NORTHRUP [WYANT] (*Michigan Sta. Rpt. 1919, pp. 242, 243*).—Six of 11 samples of silage which had caused forage poisoning in live stock, representing all but one of the sources, were found to contain an organism resembling *Bacillus botulinus* morphologically and culturally, and the toxin from the culture isolated from one of the samples of silage caused the death of the experimental animals.

Symptomatic anthrax or blackleg, J. BAGUÉ (*Porto Rico Dept. Agr. and Labor Sta. Circ. 29 (1920), Spanish ed., pp. 5–7*).—A brief popular account of this disease, which is known in Porto Rico as morriña negra.

Foot-and-mouth disease: The question of invasion, S. STOCKMAN (*Jour. Compar. Path. and Ther., 33 (1920), No. 3, pp. 153–157; also in Min. Agr. and Fisheries [London], [Vet. Dept.], Ann. Rpts. Proc. 1919, pp. 13–18; Jour. Min. Agr. [London], 27 (1921), No. 11, pp. 1004–1009*).—This is a discussion of the way in which foot-and-mouth disease is from time to time brought into Great Britain and into similarly situated countries, notwithstanding the fact that importation of susceptible live stock into Great Britain is prohibited, as has been the importation of hay and straw since 1908, except for exceptional purposes. It is pointed out that when freed from the disease in enzootic form, Great Britain is only invaded when the disease is prevalent on the Continent, and particularly when it prevails in the north of France, Belgium, and Holland. In the light of recent experience, it would also appear that the greater the prevalence on the Continent the more frequent are the invasions. The outbreaks in Great Britain, apparently, have not been modified by the prohibition of the importation of hay and straw.

The efficacy of the eradication work during the last 20 years, in which the affected animals and actual contacts have been slaughtered immediately, appears to be shown by the fact that recurrences after restocking formerly infected premises with susceptible animals are practically unknown, and that the same premises are almost never hit twice after shorter or longer intervals. Feeding stuffs, packing materials, and human beings, which represent the communication between animals of the farm and the outside world, have naturally fallen under a sustained suspicion, but it has not been possible to establish any relationship. A study of the initial outbreaks that have occurred in Great Britain over a period of 20 years shows that certain parts of the country hit are visited initially with much greater frequency than others, and that some habitually escape altogether. The possibility of the virus being air borne for any distance, either by air currents, birds, or otherwise is considered, and the evidence available is thought to indicate that particles of virus may be carried by the air.

The outbreak of and control work with rinderpest in Bulgaria during the Balkan war of 1912–13, St. Angeloff (*Arch. Wiss. u. Prakt. Tierheilk., 43 (1917), No. 6, pp. 383–420, figs. 17*).—Rinderpest, which is nearly always present in Asiatic Turkey, was found in four provinces in southeastern Bulgaria. The author deals with its clinical appearance, anatomo-pathological changes, differential diagnosis, and control measures.

Serological studies on tuberculosis.—Third contribution: Concerning precipitins and complement-fixing antibodies, Y. Nishida and S. A. Petroff (*Amer. Rev. Tuberculosis, 4 (1920), No. 5, pp. 322–339*).—In continuation of the investigation previously noted (E. S. R., 42, p. 882), studies are reported of the physical and chemical properties of the antibodies responsible for the complement fixation reaction in tuberculosis, together with a comparison of the complement-fixing antibodies and the precipitins.

Sensitized serum having a high titer of antibodies was obtained by the intravenous inoculation of sheep with human tubercle bacilli. The complement-fixing antibodies in such a serum were found to resist a considerable degree of heat, a temperature of about 70° C. being required to destroy them. X-ray radiation did not appear to destroy the antibody, antigen, or complement. Ultra-violet rays had only slight effect on the antigen, but destroyed the antibody and complement. Sunlight at 1,600 ft. elevation had very little effect on antigen, a slight effect on antibody, and more on complement.

An attempt to determine the chemical nature of the antibodies led to the conclusion that they are not of the nature of lipins but are either globulins or are carried down with the globulins.

A parallel study of the precipitation and complement fixation reactions, using three different antigens and various dilutions of active sera and of sera inactivated by heat, showed that the antibodies responsible for the two different reactions are probably the same but represent two phases of the same phenomenon.

The preparation of tuberculins for the diagnosis of tuberculosis in animals, F. Boerner, jr., and M. F. Barnes (*Jour. Amer. Vet. Med. Assoc., 58 (1920), No. 2, pp. 160–164*).—The authors call attention to the importance of the adoption of uniform methods for the preparation of tuberculins and discuss briefly the various steps in tuberculin preparation.

Combination tuberculin tests, H. W. Turner (*Jour. Amer. Vet. Med. Assoc., 58 (1920), No. 2, pp. 165–172*).—Data are presented on the results obtained by the Pennsylvania Bureau of Animal Industry in the use of different combinations of the intradermal, subcutaneous, and ophthalmic tuberculin tests. These data indicate that the intradermal test when applied three days prior to the subcutaneous interferes with the subcutaneous test by developing marked immunity to tuberculin. The application of the subcutaneous test a few days before the intradermal, while having a slight effect on the second test, did not produce as great an interference. The ophthalmic test did not appear to affect or be affected by the other tests when applied in any combination.

"From the results here shown, as well as from the observations of others, it is evident that we are in need of a uniform plan for applying the combination tests."

The superiority of combination tuberculin tests over any other method, L. B. Ernest (*Jour. Amer. Vet. Med. Assoc., 58 (1920), No. 2, pp. 173–180*).—In this paper the author discusses the experiences of inspectors of the Bureau of Animal Industry, U. S. Department of Agriculture, in the use of the combination tuberculin tests.

During 1919 experiments in testing the value of the separate reactions gave the following results: Positive reactions were obtained in 251 out of 1,216 cattle tested subcutaneously, 278 out of 1,538 tested with ophthalmic reaction, and 328 out of 1,076 tested intradermally. The percentage of animals reacting negatively but showing lesions on post-mortem examination was 5.39 in the subcutaneous, 6.75 in the ophthalmic, and 11.51 in the intradermal test. A report from several of the bureau stations for 1920 showed lesions in 96.12 per cent of the animals diagnosed as tuberculous by the subcutaneous test, 96.17 by the intradermal, and 95.12 by the ophthalmic test.

In the use of a combination of two of the three tests the subcutaneous, checked by the ophthalmic method by sensitizing the eye at the time of the first preliminary temperature reading and using the diagnostic disk at the tenth hour after the subcutaneous injection, is recommended as enabling a check on the subcutaneous test to be made within the time consumed by the subcutaneous test alone. In the combination intradermal and ophthalmic test it is recommended that the injection be made by the intradermal method and the eye sensitized by the ophthalmic disk at the same time. The diagnostic ophthalmic disk should be instilled at the sixty-seventh hour and observations made on both tests at the seventy-second hour or possibly later. "A combination of this character is of special value where the operator is not entirely familiar with intradermal reactions, in which case he will very probably, if the animals in question are tuberculous, have some eye disturbance to guide him in his classification."

A combination of the subcutaneous and intradermal tests, the latter to be applied to those animals failing to react to the former test, is considered valuable as a matter of check testing, but more time-consuming than other combination tests. In conclusion, the author emphasizes the importance of careful post-mortem examination of condemned animals.

Accuracy of tuberculin tests (*Wisconsin Sta. Bul. 323* (*1920*), *p. 31*).—In tuberculin tests conducted on a single large herd of cattle in an attempt to determine the relative value of different methods of testing, the best results were obtained from the combined sensitized ophthalmic and intradermal tests. The intravenous test failed to react in a number of the animals which showed tuberculous lesions at the time of slaughter.

Disposition of tuberculous cattle, O. H. Eliason (*Jour. Amer. Vet. Med. Assoc.*, *58* (*1920*), *No. 2*, *pp. 155–159*).—A brief description is given of a plan conducted in Wisconsin in 1918–19 of salvaging condemned tuberculous cattle by segregation on a concentration farm. The physically fit cows were milked and the milk sold to manufacturers of condensed milk. The calves were sold for veal and the cattle sold from time to time. In the plan as suggested for a permanent State project the equipment should consist of a concentration farm to which all reactors would be sent, the valuable pure breds being conspicuously marked, a second farm to which valuable cows should be sent for breeding, and a third farm where the calves should be sent until tested and passed by two tuberculin tests.

Eradicating tuberculosis in Pennsylvania, S. E. Bruner (*Jour. Amer. Vet. Med. Assoc.*, *58* (*1920*), *No. 2*, *pp. 147–154*).—The policy adopted in Pennsylvania for the control of tuberculosis under the accredited herd plan is outlined and discussed. Attention is called to statistics showing that as the disease decreases the inefficiency of the tests, as shown by inability to demonstrate the disease on autopsy, increases. Various possible causes of reaction in nontuberculous animals are mentioned, including individual idiosyncracy to tuberculin and erratic normal temperatures. It is thought that the percentage of errors may be reduced by taking into fuller consideration the complete history of the herd and by slaughtering first those which give the strongest reaction and then determining by the slaughter of one or two of those giving less decisive reactions the disposition of the others.

Botulism in cattle, R. Graham and H. R. Schwarze (*Jour. Bact., 6 (1921), No. 1, pp. 69–83, figs. 4*).—Work conducted by the laboratory of animal pathology, University of Illinois, here reported, is summarized as follows:

"An anaerobic bacillus biologically resembling *B. botulinus* (type B) was isolated from a corn silage. Several (18) cattle of the herd consuming the silage in question developed symptoms of forage poisoning on two different occasions and four animals died. It is possible that botulinus toxin in the silage was primarily related to the disease in question. The silage was regarded as unsafe for cattle, and after discontinuing its use in the daily rations the animals remained healthy.

"Botulinus antitoxin (type B) proved efficacious in protecting guinea pigs against lethal doses of toxin in unfiltered broth cultures produced by the anaerobic bacillus isolated from the corn silage.

"An opportunity was afforded to inject 43 cattle on this farm with botulinus antitoxin, and subsequently to feed them with the silage. The animals remained apparently healthy. One control or untreated animal did not show visible illness, and the value of the antitoxin in the feeding operations is therefore not conclusive. It is worthy of record that the treatment did not injure the animals, and encouragement is offered for more extensive field trials in determining the value of the antitoxin in cattle against the ill effects of otherwise nourishing rations containing *B. botulinus* toxin which heretofore has advisedly been discarded. The latter item is of importance considering the increased cost of producing grain and forage."

New method in detection of Johne's disease (*Wisconsin Sta. Bul. 323 (1920), p. 31*).—In tests for Johne's disease conducted by B. A. Beach, 24 of the 325 animals comprising the 7 herds of dairy cattle tested reacted to johnin. Post-mortem examinations were made on 15 of the reacting animals and tissues from them studied under the microscope. Acid-fast bacteria resembling Johne's bacillus were found in all but one case.

A modified method of finding the organisms microscopically was developed which consists in treating a small piece of the suspected tissue with full strength commercial formaldehyde for 1 hour, drying in an incubator or drying oven, powdering the dried tissue, and treating it with 25 per cent antiformin solution for two hours. The antiformin is diluted with an equal volume of distilled water and the sediment examined for the acid-fast organism. In studying the distribution of the organisms in the infected tissue no trace of them was found deeper than the submucous coat of the intestines, thus indicating that the organisms gain entrance to the body from the intestines.

The relation of the bacterial flora of the uterus to that of the meconium of the calf, S. G. Bandeen (*Michigan Sta. Rpt. 1919, pp. 239, 240*).—"The 24 cases studied for a comparison of the flora of the uterus and meconium showed that the 12 uteri gave cultures in 83⅓ per cent. The uterus contained more organisms than the meconium. The meconium was found to be infected with *Bacillus coli communior*, staphylococcus, and streptococcus. These organisms were also found in the uterus. *Bacterium abortus* was found to persist in the uterus for 28 days. In no case was *B. abortus* found in the meconium. In all cases, except one, whenever the meconium was infected the uterus was found to harbor the same organism. In some cases the meconium was found to be sterile, while the uterus harbored organisms. *B. coli* and certain cocci were found in the sealed uteri of apparently normal cows. The results obtained in this article will be of interest to investigators of white scours of calves who believe that the calf is infected before birth. A large percentage of calves are born with infected meconium. The uterus is first infected, probably followed by the fluids, and, lastly, the meconium. The infection probably reaches the uterus by passing through the cervix from the vagina before the seal is formed and persisting there throughout pregnancy."

[**Investigations of diseases of pigs and cattle**] (*Wisconsin Sta. Bul. 323 (1920), pp. 32–34, fig. 1*).—Considerable attention was given by F. B. Hadley to the study of the disease of pigs which, when confined to the mouth, is known as sore mouth, or necrotic stomatitis; where the nasal passages are involved, is called "bull nose"; where the lining membrane of the stomach and bowels is affected, necrotic gastritis; and where the lungs are affected, necrotic pneumonia. "The treatment of sore mouth is performed by cutting out the necrotic tissue from the ulcers and applying tincture of iodin. The mouth of the diseased pig, and every pig in the herd as well, should be flushed with a 3 per cent solution of permanganate of potash. Owing to the possibility of transfer of infection from the udder of the sow, it also should be washed with the same solution. The experience of the department is that the disease may be checked by turning all pigs out on pasture. New quarters should be provided, or the old ones cleaned thoroughly and disinfected."

Work with sterility of cows has shown that excellent results have been secured by irrigating the affected organs with a 1 per cent solution of common salt.

In vaccination against contagious abortion, the vaccine was prepared and distributed in sufficient quantity to immunize 850 head of cattle. The indications were that in a large percentage of the cases very beneficial results have followed its use.

Hairless pig trial (*North Dakota Sta. Bul. 146 (1921), pp. 24–28*).—Reports of observations by county agents and others show the State to have been nearly free from hairless litters during the year 1920.

In a comparison of exercise *v.* nonexercise for sows, 19 head were farrowed at the station, the number of normal and hairless pigs being 12 and 2 in the exercise lot, with 2 haired, 7 hairless, and 3 half hairless in the nonexercise lot. The results of 128 farrowings, covering the sizes of hairless and normal litters and the amount of overrun of the standard 16 weeks gestation period, are recorded in tabular form. With the 45 gilts, the litters of which were nearly evenly divided between hairless and normal, the normal ones averaged 26.92 per cent larger than the hairless. With the litters from the 83 sows, all but 8 of which were normal, the normal litters had 9.94 per cent more pigs than the hairless ones.

It is pointed out that hairless pigs are usually weak and very largely succumb during the first three weeks, and that there are other symptoms less readily discerned than hairlessness which are present in hairless litters. A record kept of the percentage of normal litters and of hairless litters that survived the first 10 days show that of 116 hairless pigs farrowed 13 lived 10 weeks, while of 88 normal pigs farrowed 67 lived the same period.

Hog cholera (*North Dakota Sta. Bul. 146 (1921), pp. 46, 47*).—The experimental work on hog cholera reported includes a summary of dialysis, attenuation, and dilution experiments with hog cholera virus.

The virus did not dialyze through either parchment of collodion membranes when normal salt solution or distilled water was used as the dialyzing medium. With normal pig serum as the dialyzing medium the virus evidently passed through both parchment and collodion membranes. Virus through which CO_2 or illuminating gas had been bubbled continuously for 48 hours apparently lost none of its virulence. Dilution experiments indicated that the virus is viable and potent for susceptible pigs in doses as small as 0.001 cc.

On the morphology and biology of Bacillus suipestifer, A. Trawinski (*Centbl. Bakt.* [*etc.*], *1. Abt., Orig., 80 (1918), No. 6, pp. 339–349, fig. 1*).—In investigations conducted, 42 cultures of *B. suipestifer* were made from the internal organs of 21 head which had succumbed to swine plague. All were found to possess the same morphological, biological, and agglutinating characteristics. A comparison showed them to be identical with the strain of *B. suipestifer* obtained from the Bacteriological Institute at Budapest.

Swamp fever in horses (*North Dakota Sta. Bul. 146 (1921), pp. 45, 46*).—In investigations in which Gastrophilus extract was administered to 18 horses in various ways, including subcutaneous, intradermal and intraperitoneal injection, ingestion, etc., none developed fever or showed anemia. Experiment proved that swamp fever virus loses its virulence within 65 days when preserved in chloroform.

A campaign to control chicken pox, W. C. Thompson and L. S. Dodson (*New Jersey Stas., Hints to Poultrymen, 9 (1921), No. 7, pp. 4, fig. 1*).—The general plan of a campaign for the control of chicken pox, inaugurated by the stations on July 1, 1921, in cooperation with Squibb's Laboratories and with individual poultrymen, is here described. The importance of the disease in New Jersey, where the loss to poultrymen in the fall and winter of 1919 is estimated as having amounted to $1,000,000, is pointed out and its nature described. In conducting the campaign the chicken-pox vaccine will be supplied at cost to any poultryman in New Jersey who makes a request for it and complies with certain conditions.

Wattle test for tuberculosis of poultry (*Wisconsin Sta. Bul. 323 (1920), p. 34*).—This test, which consists in injecting 0.25 cc. of avian tuberculin with a fine hypodermic needle just beneath the outer skin of the wattle, has been used by B. A. Beach with considerable success in eliminating tuberculosis from a flock of 500 chickens. If the bird is tuberculous one or both of the wattles will swell from 2 to 20 times its normal size in from 12 to 48 hours. By testing the entire flock twice each year for 3 years and removing all reactors, the mortality of the flock has been reduced from 15 per cent to less than 1 per cent annually.

The artificial incubation and brooding of turkeys, H. W. Graybill (*New Jersey Stas. Bul. 347 (1921), pp. 11, fig. 1*).—This is a report of investigations conducted at the department of animal pathology of The Rockefeller Institute for Medical Research, at Princeton, N. J., in cooperation with the State Station. The investigations indicate that in the artificial rearing of turkeys, incubation, either throughout or with the use of hens or turkeys until shortly before hatching, and brooding can be carried out with success. Contrary to a common belief, the turkey will flourish under confinement when infections are excluded. Artificial rearing, isolation from adult poultry of all kinds, and the use of noninfectious soil offer promising means of controlling blackhead in young flocks.

Carbon tetrachlorid for the removal of parasitic worms, especially hookworms, M. C. Hall (*Jour. Agr. Research* [*U. S.*], *21 (1921), No. 2, pp. 157–175*).—Following a résumé of some of the more readily available literature on carbon tetrachlorid, especially those papers dealing with the therapeutics of this drug and entomological literature, the author reports experiments conducted by the Bureau of Animal Industry, U. S. Department of Agriculture, with a view to determining its effect upon parasitic worms and upon the animals to which it is administered. In the anthelmintic experiments with dogs it was administered alone, with thymol, and with chenopodium. Comparative experiments were conducted with chloroform, chenopodium, chloroform and chenopodium, and thymol.

The results obtained led to the conclusion that "carbon tetrachlorid in less than the ascertained effective dosage (0.3 m. p. k.) or improperly administered (without capsules) removed 40 hookworms and left 55, an efficacy of only 42 per cent; but in the effective dosage of 0.3 m. p. k. in capsules it removed all the hookworms from 9 dogs and, judging from the fecal examination, apparently removed all the hookworms from 5 other dogs, an efficacy of 100 per cent. A solution of thymol in carbon tetrachlorid in capsules was likewise 100 per cent effective against hookworms in the 2 infested dogs to which it was given. A solution of chenopodium in carbon tetrachlorid in capsules was likewise 100 per cent effective against hookworms in the one infested dog to which it was given.

"On the other hand, chloroform in doses of 0.1 to 2 m. p. k. in castor oil was only 54 per cent effective against hookworms; in single or repeated doses in soft capsules it was entirely ineffective.

"Chenopodium and its constituents in single or repeated doses have an average efficacy of 20 per cent against hookworms; in the dose commonly employed for removing hookworms from man, three 10-minim doses at 1-hour intervals, it is only 30 per cent effective, and its maximum efficacy in any series of dogs used is only 74 per cent.

"Chloroform and chenopodium for all cases reported shows an average efficacy of 69 per cent, the maximum efficacy for a series being 89 per cent in cases where dogs were given three 5 to 10 minim doses in soft capsules at 1-hour intervals, each dose accompanied by 0.5 oz. of castor oil and followed a half hour later by 4 mils of chloroform in 0.5 oz. of castor oil, this dose of chloroform being in excess of 0.3 m. p. k. for the average dog (a 10-kg. dog).

"Thymol shows an efficacy of 15 per cent and, according to Gaiger's record, left hookworms in 7 of 9 dogs treated, with no evidence as to infestation on the part of the other 2 dogs.

"Nothing heretofore reported for experimental tests of anthelmintics on dogs shows the 100 per cent efficacy for a series of tests against hookworms that carbon tetrachlorid does. The best results heretofore have been obtained by repeated doses of chenopodium followed by chloroform. Chloroform alone appears to be better than chenopodium alone, and thymol makes a very poor showing."

RURAL ENGINEERING.

The Venturi flume, R. L. Parshall and C. Rohwer (*Colorado Sta. Bul. 265 (1921), pp. 3–28, pls. 7, figs. 14*).—Experiments conducted in the hydraulic laboratory at Fort Collins, Colo., at Cornell University, and at the field laboratory at Bellevue, Colo., under a cooperative agreement between the irrigation division of the Bureau of Public Roads of the U. S. Department of Agriculture and the Colorado Station, are reported. The report is intended to present a more complete statement as to the law of flow through the Venturi flume and to define more clearly its limitations and advantages than was done in a previous contribution from the station (E. S. R., 37, p. 282).

It is stated that the Venturi flume is intended to meet those conditions for which the standard weir or other measuring devices are not suited, the most important application being where sufficient head is not available for other types of measuring devices. Its accuracy is said to be sufficient to meet ordinary requirements, and by actual computation it has been shown that for all sizes of rectangular flumes investigated with discharges ranging from less than 1 sec.-ft. to nearly 400 sec.-ft., 94 per cent of all tests show an error in discharge of 5 per cent or less. A similar comparison for the V-notch flume shows that for discharges ranging from 0.1 to 10 sec.-ft., 70 per cent of all the tests show an error of 2 per cent or less.

The following formula is given for discharges through the rectangular Venturi flume:

$$Q=\left[(0.9975-0.0175W)+\frac{(H_d-0.163\ H_a^{\frac{1}{2}})^2}{\left(\frac{8}{20-W}\right)H_a^2}\right]WH_b\sqrt{\frac{2g\ H_d}{1-\frac{9}{49}\left(\frac{H_b}{H_a}\right)^2}}$$

where Q=discharge in second feet, W=width of throat in feet, H_b=head at the throat in feet, H_a=head in converging section in feet, and $H_d=(H_a-H_b)$=difference in the two heads. Logarithmic discharge diagrams for rectangular Venturi flumes varying in width from 1 to 5 ft. are given, based on this formula.

The following formula is given for the discharge through V-notch Venturi flumes:

$$Q=C\frac{H_b^2}{2}\sqrt{\frac{2g\ H_d}{1-\frac{H_b^4}{(2\frac{2}{3}+H_a)^2\ H_a^2}}}$$

where Q=discharge in second feet, $C=0.930+(4.07-1.4H_a)\ (H_d-0.05\ H_a-0.04)^2-\frac{0.362}{e^{80H_d}}$, H_a=upper head in feet, H_b=throat head in feet, $H_d=(H_a-H_b)$=difference in head in feet, $e=2.7183$. A logarithmic discharge diagram corresponding to this formula is also given.

The application of the formulas given is not recommended for determining discharges for flumes having throat widths or depths beyond the limits of those shown in the diagrams, as the results will be only approximations.

In order to obtain the best results from the rectangular Venturi flume, it is recommended that four gauge wells be installed and that the mean reading be used in determining the discharge. Frequent testing of the sensitiveness of the gauge wells is considered advisable. Scales or gauges attached to the inside surface of the flume for determining the head are said to be not sufficiently accurate for general purposes. It is also considered advisable, if the head is available, to operate the flume with the greatest difference in head possible since the accuracy increases as the difference in head increases.

Ground water in the Meriden area, Conn., G. A. WARING (*U. S. Geol. Survey, Water-Supply Paper 449* (*1920*), *pp. 83*, *pls. 7*, *figs. 10*).—This report, prepared in cooperation with the Connecticut State Geological and Natural History Survey, deals with the geography, geology, and ground water supplies of an area in the south-central part of the State of Connecticut.

Analyses of samples of ground water from various parts of the area are reported, showing a range in total dissolved solids of from 80 parts per million of water in a well ending in till to 367 parts per million in a well ending in trap. The lowest average of total solids was shown by spring waters. In general, the waters from the rock formations were noticeably more highly mineralized than those from the glacial drift. Nearly all of the waters are of the calcium carbonate type. Chlorids were found to form only a small percentage of the total dissolved solids. Nitrates reached a maximum amount in the water from a well ending in stratified drift. The high nitrate content of this water and some of the other waters may be due to the presence of considerable organic matter, but it is considered evident that pollution exists in a number of the waters.

Surface water supply of Missouri River Basin, 1917 (*U. S. Geol. Survey, Water-Supply Paper 456 (1921), pp. 242+XLII, pls. 2*).—This report, prepared in cooperation with the States of Colorado, Montana, Wyoming, and Kansas, presents results of measurements of flow made on streams tributary to the Missouri River Basin during the year ended September 30, 1917.

Surface water supply of the Pacific slope of southern California, H. D. McGLASHAN (*U. S. Geol. Survey, Water-Supply Paper 447 (1921), pp. 557, pls. 18*).—The result of measurements of flow made, in cooperation with the State of California, on streams and basins of the Pacific slope of southern California are presented.

Surface water supply of Pacific slope basins in California, 1918 (*U. S. Geol. Survey, Water-Supply Paper 481 (1921), pp. 314+XXXVIII, pls. 2*).—This report, prepared in cooperation with the States of California and Oregon, presents the result of measurements of flow made on streams in the drainage basins of the Pacific slope in California during the year ended September 30, 1918.

Coeur d,Alene Lake, Idaho, and the overflow lands, R. W. DAVENPORT (*U. S. Geol. Survey, Water-Supply Paper 500–A (1921), pp. [2]+31, pls. 3, figs. 4*).—This report deals with the general features and physical conditions of Coeur d'Alene Lake in Idaho and its overflow lands, the purpose being to render a statement in connection with a controversy between a water-power company and the land owners as to the rights of the company in causing overflow of the lands.

Hydrology and agricultural use of water in Tunis, P. LANDESQUE (*Dir. Gén. Agr., Com., et Colon. [Tunis], Bul. 24 (1920), No. 102, pp. 201–258, pls. 4, figs. 4*).—This is a general report on the surface and subsurface water supplies of Tunis and their use for irrigation.

Data on rainfall and on the movement of water supplies are given in the first chapter, with special reference to deep infiltration and ground-water movement. Attention is also drawn to the hot springs and geysers. It is stated that the waters of Tunis are in general highly mineralized, containing mostly salts of sodium, calcium, and magnesium.

The second chapter deals with the improvement of water courses and sources and the use of the surface water for irrigation. General data are given on the design of dams, reservoirs, and canals, and specific structures are briefly described.

A third chapter deals with the influence of forests in the improvement of water-supply conditions in Tunis.

An appendix gives data on the quality of Tunisian water supplies.

Drainage settles peat marshes (*Wisconsin Sta. Bul. 323 (1920), pp. 39, 40*).—Drainage experiments in peat soil conducted by E. R. Jones and G. R. B. Elliott have shown that the settling of peat deposits is limited in nearly all cases to that above the tile. Settling was found in the grade line of the tile only where the water table fell below the tile. These results are taken to indicate that the decomposition of the peat proceeds at the greatest rate in well-drained soil. The records also indicate that half of the settling during six years occurred during the first two years of drainage.

Are concrete tile durable? (*Wisconsin Sta. Bul. 323 (1920), p. 39*).—Investigations on the efficiency of concrete tile in six counties, by G. R. B. Elliott, showed that in soils free from acid, well-made concrete tile disintegrate but little, but where the tile was laid in peat soils quite marked disintegration occurred. The action appeared to be between the soil acids and the cement so that the tile gradually dissolved and crumbled.

On this basis the following specifications were prepared and accepted for use by concrete tile manufacturers: Mixture 2½:1 or richer by weight, controlled vapor for curing, washed sharp aggregate, density sufficient to prevent absorption exceeding 7 per cent, and extra wall thicknesses and densities for tile to be used in acid soils.

Testing war-salvaged explosives for land clearing (*Wisconsin Sta. Bul. 323 (1920), p. 40*).—Winter tests made under cold temperature with dry Grade—II TNT and with moist materials, by J. Sweneharl, showed that freezing temperatures have no effect on either its detonation or strength. TNT containing from 5 to 10 per cent of water when frozen showed no different detonation than when the material exploded was at ordinary temperatures.

It was also found that Grade—III TNT is less sensitive than either Grade—I or Grade—II. It was found better to detonate TNT with a primed dynamite cartridge than with No. 8 caps alone. A small percentage of moisture in grenade powder was found to interfere with detonation. Black blasting powder was also found to be too insensitive and to be affected by moisture.

Analysis of roughness impact on highway bridges, W. WHITED (*Engin. News-Rec., 86 (1921), No. 14, pp. 582, 583, fig. 1*).—An analysis of the impact on highway bridges due to roughness of the road is presented.

The phases of the subject analyzed are (1) the impact produced when a truck wheel strikes an obstacle and (2) the impact when it jumps off the obstacle. Floor irregularities are considered to be the principal source of impact, and a formula is derived which indicates that when a wheel strikes an obstacle there is an increase of two-thirds the load for 3-in. roughness.

It is concluded that the most logical basis for computing impact in any member of a highway bridge is to assume that "to add to the maximum stress due to the assumed maximum static load a stress equal to that due to a single load about two-thirds the sprung load on any wheel, applied at whatever point on the bridge floor, will give the maximum stress in the given member."

Impact under high-speed traffic on highway bridges, W. D. UHLER (*Engin. News-Rec., 86 (1921), No. 14, pp. 583, 584*).—An analysis of impact of trucks on highway bridges leads to the conclusion that it is sufficient to provide for an obstacle 3 in. high, and that "if bridges are designed for the specified load applied statically with an additional impact load of one specified wheel load plus about 20 per cent, applied at whatever point on the bridge will produce a maximum stress in the member under consideration, ample allowance will be made for all impact stresses, and 20 per cent impact on all wheels will give a wide margin of safety."

Public Roads (*U. S. Dept. Agr., Public Roads, 4 (1921), No. 1, pp. 24, figs. 6*).—This number of this periodical contains the usual project statement under Federal-aid allowances approved in March, 1921, and the following articles:

Crushed Stone and Gravel Roads, by C. L. McKesson and A. F. Morris; British Road Classification; Capillary Moisture and Its Effect on Highway Subgrades, by W. W. McLaughlin; Scholarship Essay Contest Announced; Bituminous Pavements Laid on Old Macadam Streets in Denver, by J. W. Johnson; The President's Message on Federal Highway Policies; and Sand and Gravel Production Survey of Twenty-two States, by G. E. Ladd.

Investigation to determine the draft of various farm implements (*Missouri Sta. Bul. 179 (1921), p. 14*).—Investigations by M. M. Jones to determine the influence of speed upon the draft and power consumption of a 2-bottom, 12-in. general purpose plow, drawn by a tractor, showed that increasing the plow speed increased the draft and the power consumption of the plow very materially. Increasing the plow speed from 2 to 3 miles per hour, which increased the work done 50 per cent, increased the draft 11.3 per cent and the power consumption 67 per cent; increasing the plow speed from 2 to 4 miles per hour, which increased the work done 100 per cent, increased the draft 24.8 per cent and the power consumption 149.5 per cent.

Sharpen the sickle to save the horse (*Wisconsin Sta. Bul. 323 (1920), p. 40*).—Draft tests made on a used mower by F. W. Duffee with the cutter bar in good and poor condition showed that when the knife was dull and the bar in poor adjustment, the draft was increased from 30 to 35 per cent. Very little was gained by sharpening the knife and leaving the bar in poor adjustment.

Unprotected electric lights.—A recently developed dust explosion and fire hazard, D. J. PRICE and H. R. BROWN (*U. S. Dept. Agr., Dept. Circ. 171 (1921), pp. 7, fig. 1*).—Experiments to determine whether or not the exposed filament in a broken electric lamp will remain hot long enough after the globe is broken to ignite a surrounding dust cloud are reported.

The tests were made in an explosion chamber fitted with a socket to hold lamps of various sizes, and a rod with trigger release to smash the lamps. A dust cloud was produced by blowing dust from small shelves along the side of the chamber. Explosions were obtained with both vacuum and gas-filled lamps. The only exception was with vacuum tungsten and carbon lamps of very low wattage. It is concluded therefore that dust explosions and fires can be caused by the breaking of an electric lamp in a dust cloud.

Tests made to ascertain the danger due to the ignition of the dust on the globe are also reported. Temperature readings of the various types of vacuum and gas-filled lamps on the market were compared with the ignition temperatures of the various dusts found in industrial plants. It was found that the temperature of the dust must be raised at least 150° F. above the maximum temperature of the bulb to cause ignition. In a specially construced chamber, in which a continuous dust cloud may be maintained, it was found possible to start a fire on the larger gas-filled lamps with each of four different carbonaceous dusts. It is believed from these results that any combustible dust, if allowed to collect on a lamp in sufficiently thick layers and remain long enough, will ignite. Methods of fire and explosion prevention are discussed.

Methods for close automatic control of incubating temperatures in laboratories, J. T. BOWEN (*U. S. Dept. Agr. Bul. 951 (1921), pp. 16, figs. 13*).—Methods and apparatus for the close automatic control of incubating temperatures used in the Bureau of Animal Industry are described and illustrated and structural features are discussed.

RURAL ECONOMICS AND SOCIOLOGY.

The bases of agricultural practice and economics in the United Provinces, India, H. M. LEAKE (*Cambridge, England: W. Heffer & Sons, Ltd., 1921, pp. VII+277, figs. 10*).—The origin of agriculture, the physical bases of plant growth, and the development of crop cultivation, together with the application of general economic principles to agriculture are discussed in this series of classroom lectures. The author adheres closely in his illustrations to Indian agriculture, institutions of land holding, customs, and living conditions. The rôles of the large landholder, the Government, and the money lender in the future development of the agriculture of the country are outlined.

Rural New York, E. O. FIPPIN (*New York: Macmillan Co., 1921, pp. XVI+381, pls. 9, figs. 36*).—This volume is the first of a new Rural State and Province Series, edited by L. H. Bailey. It gives a description of the physical conformations and climatic conditions of the State, and of the historical development of agriculture there, with an account of agricultural and other related resources. Markets and marketing facilities, rural manufactures, and administrative and regulatory as well as educational and research organizations are outlined.

[Report of the work of the rural life department] (*Missouri Sta. Bul. 179 (1921), pp. 45–49*).—The results of a number of projects not noted before are reported on as follows:

Tractor and other farm equipment costs on the farm, O. R. Johnson and R. M. Green (p. 45).—The equipment charge for horsepower equipment and smaller tools is frequently prorated to different enterprises on the basis of the number of horse hours expended, and equipment charge is therefore expressed in terms of cost per horse hour. A summary of these costs given here indicate a range of from 2.3 cts. in 1914 to 3.7 cts. in 1918, and in cash outlay for repairs, replacements, and additions in percentage of average inventory values of from 28 per cent in 1914 to 42 per cent in 1918.

Cost of producing farm products under farm conditions, O. R. Johnson and R. M. Green (pp. 45, 46).—The work of setting up quantitative cost formulas from data contained in 16 sets of accounts from 14 counties is reported on. Using the "wheat formula," the cost of producing the 1919 crop in Missouri was determined in July, 1919, as being $25.27 an acre. The yield was estimated at 13 bu. to the acre, giving a cost per bushel of $1.94. The final yield reported for the year was 13.5 bu., on the basis of which the cost per bushel would have been $1.87. Using the same formula the average cost per bushel of wheat at 1920 prices is said to have been determined as $2.26 on the basis of a 12.75-bu. yield. The average total labor requirements of various crops included in this study are tabulated.

The agricultural and market value of Missouri farm lands, O. R. Johnson and R. M. Green (pp. 46, 47).—A plan of obtaining the agricultural value of Missouri farm lands on the basis of 1910 data for average acreage and yields and average prices for the 1900–1910 period, as well as certain cost of production figures, is outlined here, and a partial report of results including eight counties is given.

Land tenure in Missouri, O. R. Johnson (p. 47).—This brief report indicates that the share tenant has the least capital, obtains the more fertile land, and is a better feeder of live stock, getting $145 for each $100 worth of feed fed, compared to $126 for the cash tenant. The latter, however, is said to be doing the bigger live-stock business. The share tenant was found to pay 82 per cent more rent to the acre than does the cash tenant, and to pay the landlord nearly twice the interest on investment that the cash tenant pays.

The standard of living on the farm as a factor in the cost of production, O. R. Johnson and R. M. Green (p. 47).—Household expenses of 12 or 14 farms that kept complete accounts continuously for several years are tabulated. The average cash household expense per farm was found to have increased from $416 in 1914 to $1,082 in 1920, or 260 per cent.

Utilization of labor on the farm, O. R. Johnson and R. M. Green (pp. 48, 49).—The man and horse hours required in the various operations of corn growing under north Missouri conditions in 1914 when the corn is gathered from standing stalks and when gathered from the shock, are tabulated here.

Importance of farm cost accounting, W. M. Jardine (*Kansas State Bd. Agr. Quart. Rpt., 39 (1920), No. 153, pp. 35–48, fig. 1*).—It is said that in view of the difficulties involved in obtaining figures on the cost of producing farm products, it becomes a function of the State and Federal governments to determine these costs and obtain the other information needed. A brief account is given of the cost of production investigations by the Kansas Experiment Station, cooperating with the Office of Farm Management and Farm Economics of the U. S. Department of Agriculture, and the cost per acre of growing the 1918 crop of wheat on 300 farms in 12 counties in Kansas is tabulated in detail. The 1917 business on a Kansas farm, showing expenses and their distribution by complete cost accounting, is also tabulated.

[Cost of production on the North Dakota College demonstration farms in 1920], E. I. OLSEN (*North Dakota Sta. Bul. 148 (1921), pp. 4–33, 36–38, fig. 1*).—Farming operations followed on the various fields of the 19 demonstration farms in 1920 are set down briefly, and costs are computed from accounts rendered in superintendents' reports, using certain unit values found in U. S. Department of Agriculture publications. Crops and yields are tabulated.

The farmer's economic problem, H. C. TAYLOR (*Kansas State Bd. Agr. Quart. Rpt., 39 (1920), No. 153, pp. 26–35*).—Figures relating to the cost of producing cotton in 1913 and in 1918 on different farms in Sumter County, Ga., are tabulated for the purpose of illustrating the differences between average cost and bulk-line cost, and to point out the necessity of having the price somewhat above the average cost if farmers are to prosper in the production of an important staple crop.

Records from 35 McPherson County, Kans., farms are also tabulated. From these it is indicated that the average cost of producing wheat in 1919 was $2.43 per bushel. About 60 per cent of the wheat was produced at an average cost or below, but in order to cover the cost of 85 per cent of the product it would be necessary for the price to go slightly above $2.95. Another table is given showing the basic requirements in producing an acre of wheat on the basis of data from the same group of farms, all of this being given to show the kind of cost data which can be obtained and to indicate the way in which it should be interpreted.

The subjects of farm finance and farm labor problem are also briefly discussed.

A system of accounts for live-stock shipping associations, C. N. WILSON (*Wis. Div. Markets Bul., 1 (1920), No. 4, p. 14*).—Blank forms and brief descriptive notes are offered.

A system of accounts for cooperative warehouses, C. N. WILSON (*Wis. Div. Markets Bul., 1 (1920), No. 5, pp. 30*).—As a result of a survey of the accounting methods used at a number of points in the State, various distinct types of accounting were found. The system outlined in this bulletin is offered to enable cooperative warehouses to comply with requirements of the law and to facilitate the making of income-tax returns.

A system of accounts for cheese factories, C. N. WILSON (*Wis. Div. Markets Bul., 1 (1920), No. 8, pp. 16*).—The suggested accounting blanks and brief interpretive text are presented with the idea of assisting the standardization of business methods in the cheese industry of Wisconsin.

International yearbook of agricultural legislation (*Inst. Internatl. Agr. [Rome], Ann. Internatl. Lég. Agr., 9 (1919), pp. LIX+1130*).—This volume continues information previously noted (E. S. R., 42, p. 390).

Foundations of agricultural prosperity, R. T. ELY (*Chicago: Amer. Farm Mortgage Bankers' Assoc., 1920, pp. 15*).—In this address the effect of the tax exemption feature of many modern securities in influencing investment otherwise than in land is pointed out. It is said that real estate taxation is higher in the United States than in foreign countries, and figures are given in support of the statement. Investigation of land economics and the relation of land and agricultural labor are urged, and attention is called to The Institute for Research in Land Economics, established in October, 1920.

Farm tenancy leads to ownership (*Wisconsin Sta. Bul. 323* (*1920*), *p. 48*).—This brief note indicates that from a recent survey of farm tenancy in Wisconsin, by B. H. Hibbard and J. D. Black, the facts were brought out that during recent years ownership is delayed to a later period in a man's life, and that for the first purchase of land by the men interviewed five-sixths of the money required was furnished by relatives or by retired farmers of the neighborhood.

The world's wheat problem, R. T. HINCKES (*Hereford, England: Hereford Times, Ltd.* [*1920*], *2. ed.*, *pp. 15*).—This subject is presented from the point of view that a certain amount of home-grown wheat is important in British national economy. Prewar tendencies toward the development of specialized markets and special trade between countries, upward trends in prices, and various factors operating to check the expansion of the world's wheat acreage are discussed, and the existing world supply and demand are estimated. The passing of local wheat mills in England, and the competition of oats, barley, and other grains that are easily fed to live stock are given as considerations in the decrease of home-grown wheat. The guarantee system of encouraging home production is held to be ineffective, and option contracts are favored. It is said, however, that the high prices then prevailing will inevitably increase the immediate world production.

Monthly Crop Reporter (*U. S. Dept. Agr., Mo. Crop Rptr.*, *7* (*1921*), *Nos. 4*, *pp. 37–48*, *figs. 2; 5*, *pp. 49–60*, *figs. 2*).—Monthly estimates of crop acreage, condition, and yields, with summaries and comparisons over various periods and the usual data relating to farm value and prices, numbers of live stock, and the farm labor supply are given in these numbers. In the first-named, brief notes summarizing field reports on April 1, 1921, by States in regard to important crops are also included. A special tabulation of the acreage and value of crops grown in 10 Southern States, 1916 to 1920, inclusive, and five-year averages for the periods 1915–1919 and 1910–1914 is presented in order to bring out the extent of diversification in the cotton-producing section.

No. 5 consists largely of reports on the condition of crops and farm animals May 1. A special tabulation, graphically illustrated, indicates the estimated yearly acreage tonnage of 11 crops hauled on country roads, 1915–1919.

The Market Reporter (*U. S. Dept. Agr., Market Rptr.*, *3* (*1921*), *Nos. 19*, *pp. 289–304*, *figs. 4; 20*, *pp. 305–320; 21*, *pp. 321–336*, *figs. 2; 22*, *pp. 337–352*).—Abstracts of information on domestic movement, imports and exports, prices, and the situation in the market of specified commodities and important classes of agricultural products, together with analyses of foreign market conditions, are given. Special articles in No. 19 set forth the use of lard substitutes, review the development of wheat production in Argentina, and present a summary of milk marketing costs found in Columbus, Ohio. No. 20 contains a brief article showing wheat exportations from Australia through a period of years. In No. 21 there are special articles setting forth the expansion of the world's trade in condensed milk and describing the importance of the grain hay crop west of the Rockies.

Wisconsin agricultural statistics for 1919, annual crop and live-stock review, J. A. BECKER (*Wis. Dept. Agr. Bul. 28* [*1920*], *pp. 99*, *figs. 12*).—General summary notes are given showing estimates of the acreage and value of 27 crops, including flaxseed and timothy seed, also the number of farms, land values, and farm wages in Wisconsin in 1919, with comparisons of data for earlier years. Discussion, tables, and graphs show the increase in average crop yields in the United States and Wisconsin since records of crops were first made in 1866. Thirty-two tables embody statistical information secured cooperatively by State and Federal officials.

Live stock and animal products statistics, 1909–1919 (*Canada Bur. Statis., Live Stock and Anim. Prod. Statis., 1909–1919, pp. 131, pls. 2, figs. 27*).—The present report introduces a series designed to cover production and trade in Canada during the war period and in prewar years for comparison. Tables are offered summarizing data from censuses, annual reports, monthly records of imports and exports, cold storage holdings, and wholesale and retail prices, and other official sources. These tables relate to live stock, meats and dairy produce, the international market situation, and prices in Canada. Charts are given illustrating variously animals on farms; monthly cold storage holdings; annual British importation of meats and produce, showing also Canada's net exports and British import prices, 1900–1918; United States foreign trade in meats and dairy produce, showing also wholesale prices at the principal markets compared with Dun's index numbers, 1895–1918; and comparison of live stock receipts at the principal markets with prices.

[Agricultural and live stock statistics of Finland] (*Statis. Årsbok Finland, n. ser., 16 (1918), pp. 124–160; 17 (1919), pp. 94–115*) —Agricultural statistics in these volumes continue the series previously noted (E. S. R., 41, p. 388).

Prices and wages in India (*India Dept. Statis., Prices and Wages India, 35 (1920), pp. [VII]+244, figs. 2*).—Wholesale and retail prices of food grains, other agricultural products, and live stock, as well as wages, have been added to similar statistics for previous years, bringing up to the year 1919, and in some cases up to 1920, the series previously noted (E. S. R., 42, p. 291).

AGRICULTURAL EDUCATION.

R U S: A register of the rural leadership in the United States and Canada, compiled by L. H. Bailey (*Ithaca, N. Y.: Author, 1920, pp. 533*).—This revised edition of the rural Who's Who, previously noted (E. S. R., 41, p. 897), contains 4,631 entries. Directories are also appended of the national agricultural and rural societies in the United States and Canada, journals devoted to agriculture and rural life, official provincial and State departments of agriculture, and the colleges and schools of agriculture.

Agricultural education conference (*Fed. Bd. Vocat. Ed., Vocat. Summary, 3 (1921), No. 11, pp. 177–179*).—The outstanding features are given of committee reports submitted at the fourth annual regional conference of State supervisors and teacher trainers of the southern region, held at Montgomery, Ala., January 3–5, 1921.

It was recognized that in the organization of a year's work in vocational agriculture teachers should make a thorough survey of their particular communities. The course of study should be issued and its length prescribed by the individual teacher rather than the State supervisor or the State office. The course should be based upon a careful analysis of the farm enterprises and farm jobs, both productive and nonproductive. Farm shopwork should become an integral part of the agricultural course rather than a separate course.

It was recommended further that separate departments responsible directly to the institutional administration should be organized in teacher-training institutions. Teacher-training work as a whole should begin in the junior year, and a committee of the agricultural faculty in the agricultural college should be organized to study curriculum problems in the training of vocational teachers. The teacher-training department should continue training its graduates after they have become vocational teachers through itinerant teaching for at least one year. All members of the teacher-training staff should have an opportunity to do some itinerant teacher-training work, and likewise, all itinerant teachers should be given an opportunity to do some resident work. More or less opposition was expressed to the idea of having local teachers away from their respective localities during the summer months, and where summer schools are offered, they should be for men who have not completed either the technical or professional work in teaching. When teachers are required to be away from their localities for more than four weeks at a time a substitute teacher should be engaged to supervise the practical work. A definite recommendation was that a short intensive course, not to exceed four weeks in length, for State supervisors and teacher trainers now in service, be given at some point within the southern region during 1921, in cooperation with the Federal Board for Vocational Education.

Statements are made of the minimum standard approved for directed or supervised practice work; the fundamentals approved for part-time and evening work and for vocational education for negroes; means for advertising and promoting vocational agricultural education within the respective States; community activities considered a definite part of the agricultural teacher's job; courses recommended in teacher-training work; and conditions for judging the work of the local teacher by itinerant men.

Third annual report of the State Board for Vocational Education, 1920, T. E. JOHNSON ET AL., M. L. BURTON, F. S. KEDZIE, and F. JEFFERS (*[Mich.] Bd. Vocat Ed. Bul. 209* (*1920*), *pp. 20*).—This is the report of progress in vocational education in Michigan for the year ended June 30, 1920. During the year 59 schools offered courses in vocational agriculture with a total enrollment of about 2,650 students in agriculture. The agricultural instructors were employed for the 12 months of the year. Thirteen all-day schools, with a total enrollment of 1,319 students, and 10 evening schools, with a total enrollment of 2,446, had courses in vocational home economics. There were 61 teachers in training in vocational agriculture and 60 in vocational home economics at the Michigan Agricultural College, and 15 in home economics at the Michigan State Normal College. Statistical tables are included.

Proceedings of the first national conference on rural school consolidation (*Bul. Iowa State Teachers Col., 20* (*1920*), *No. 4, pt. 2, pp. 85*).—This report of the proceedings of the first national conference on rural school consolidation held at Cedar Falls, Iowa, February 17–19, 1920, includes brief surveys of the present status of the consolidation of rural schools in the various States, and among others, committee reports and papers on the course of study, the preparation of teachers, some things we have learned about rural school consolidation, the problems of transportation and good roads as related to consolidation, the advantages and disadvantages of the various units of taxation and administration, the rural high school in connection with and as made possible by rural school consolidation, the need of more money in the consolidation of schools, and the library in the consolidated schools.

[Nature study] (*Nature-Study Rev., 17* (*1921*), *No. 2, pp. 47–51, 55–86, fig. 1*).—This issue includes a report of the proceedings of the fifteenth meeting of the American Nature Study Society held December 29, 1920, and the following papers:

A survey of twenty years' progress made in the courses of nature study, A. J. Patterson (pp. 55–62).—The author summarizes her survey as follows: "The earliest outlines and courses were largely in the form of questions. Few of them made any attempt to grade the work. Most of them were overtechnical for children. The period from about 1897 to 1905 brought out a large number of graded courses with many helpful books, outlines, and suggestions for teaching. The 10 years from 1905 to 1915 saw nature-study outlines in most of the State courses and in a large number of city systems. The courses were in the main uniform both in the matter of material used and the method of attack. The last 5 years has been a period of sifting and shifting, of revising and testing in the light of child study, which has resulted in a better adaptation of the material and method to the needs of developing children."

A survey of twenty years' progress in nature study in providing materials for study, E. E. Shaw (pp. 63–67).—This is a discussion of the progress made along the lines of choice and use of nature-study materials.

A survey of twenty years' progress in measuring results in nature study, E. R. Downing (pp. 68–70).—This is a copy of the author's revised range of information test in science.

A survey of twenty years' progress in nature study in extension work, A. F. Satterthwait (pp. 71–80).—The author discusses the progress made in the various phases of extension work, including corn-growing contests begun in 1901 in Illinois, boys' clubs started in 1902 in Ohio, and farmers' cooperative demonstration work in the South begun in 1904 and developed to include girls' clubs in 1910, together with results of the work.

Reaching and training rural teachers, E. L. Palmer (pp. 81–86).—An attempt to so simplify and organize the sources of information available to rural teachers that nature study may practically take care of itself is presented.

Syllabus of an introductory course on part-time education (*Calif. Univ., Vocat. Ed. Bul. 1 (1920), pp. 190, fig. 1*).—This syllabus is intended for administrators and teachers of special classes to be established under the California compulsory part-time education act, approved May 27, 1919. Among the topics outlined are Part-time Education in Agriculture, by F. L. Griffin and S. H. Dadisman, and Part-time Education in Home Economics—Organization and Administration, Class Organization and Courses of Study, by M. I. Murchie. The text of the law, an article on Instruction in Vocational Agriculture in Wood County, Wis., by W. S. Welles, etc., are appended.

MISCELLANEOUS.

Thirty-third Annual Report of Colorado Station, 1920, C. P. Gillette et al. (*Colorado Sta. Rpt. 1920, pp. 42*).—This contains the organization list, a financial statement for the fiscal year ended June 30, 1920, a report of the director on the work of the station, and departmental reports. The experimental work reported is for the most part abstracted elsewhere in this issue.

Annual Report of Idaho Station, 1920, E. J. Iddings (*Idaho Sta. Bul. 122 (1921), pp. 64, figs. 3*).—This contains the organization list, a report of the director, and financial statements for the Federal funds for the fiscal year ended June 30, 1920, and for the remaining funds for the fiscal year ended December 31, 1920. The experimental work reported is for the most part abstracted elsewhere in this issue.

Thirty-second Annual Report of Louisiana Stations, 1920, W. H. Dalrymple (*Louisiana Stas. Rpt. 1920, pp. 32*).—This contains the organization list, a financial statement regarding the Federal funds for the fiscal year ended June 30, 1920, and the State funds for the fiscal year ended December 31, 1920; and a report by the director, including brief departmental reports. The experimental work reported is for the most part abstracted elsewhere in this issue.

Thirty-second Annual Report of Michigan Station, 1919, R. S. Shaw et al. (*Michigan Sta. Rpt. 1919, pp. 227–734, figs. 124*).—This contains a financial statement for the year ended June 30, 1919; reports of the director and heads of departments on the work of the station during the year, the experimental features of which have been for the most part abstracted elsewhere in this issue, and reprints of Bulletins 282–284, Special Bulletins 90–97, Technical Bulletins 43 and 44, and Circulars 36–40, all of which have been previously noted.

A report of work at McNeill Branch Experiment Station, from 1912 to 1917, inclusive, E. B. Ferris (*Mississippi Sta. Bul. 188 (1920), pp. 23*).—The experimental data included in this report are for the most part abstracted elsewhere in this issue. Meteorological observations are also summarized, as noted on page 210, and a discussion is included of the progress made in live stock and horticultural investigations.

Report of work at South Mississippi Experiment Station for 1918, 1919, and 1920, E. B. Ferris (*Mississippi Sta. Bul. 194 (1920), pp. 3–23*).—Work at this substation, located at Poplarville since its removal from McNeill in 1919, is reported for the seasons of 1919 and 1920. Data relating to field crops are noted on page 223 of this issue.

What the agricultural experiment station is doing for Missouri, July 1, 1919, to June 30, 1920, F. B. Mumford (*Missouri Sta. Bul. 179 (1921), pp. 60, figs. 17*).—This contains the organization list, a report by the director on the work and publications of the station, and a financial statement for the Federal funds for the year ended June 30, 1920. The experimental work reported is for the most part abstracted elsewhere in this issue.

Thirty-second Annual Report of New York Cornell Station, 1919, A. R. Mann (*New York Cornell Sta. Rpt. 1919, pp. CIV+1106+8, pls. 57, figs. 135*).—This report, presented as usual as that of the dean and director of the New York State College of Agriculture and the Cornell Station, contains the organization list, data relating to the work and publications of the station, a financial statement for the fiscal year ended June 30, 1919, and reprints of Bulletins 398 and 399 and Memoirs 13–27, all of which have been previously noted.

Thirty-third Annual Report of New York Cornell Station, 1920, A. R. Mann (*New York Cornell Sta. Rpt. 1920, pp. 79+4*).—This report embodies data corresponding to the above for the fiscal year ended June 30, 1920, but contains no reprints of bulletins or other publications.

Report of the director, July 1, 1919, to June 30, 1920, P. F. Trowbridge (*North Dakota Sta. Bul. 146 (1921), pp. 48, figs. 7*).—This contains the organization list, a report of the director, and a financial statement for the fiscal year ended June 30, 1920. The experimental work reported is for the most part abstracted elsewhere in this issue.

Twelfth to Eighteenth Annual Reports of Edgeley Substation, 1914–1920, O. A. Thompson (*North Dakota Sta. Bul. 145 (1921), pp. 44*).—This bulletin contains meteorological data and brief summaries of the lines of work at this substation from 1914 to 1920, inclusive. The experimental work reported is for the most part abstracted elsewhere in this issue.

Fifteenth Annual Report of the State demonstration farms, 1920, E. I. Olsen (*North Dakota Sta. Bul. 148 (1921), pp. 38, figs. 8*).—Weather conditions during the growing season of 1920 and data as to cost of crop production, yields, and wheat milling and baking tests are briefly summarized. The experimental work reported is for the most part abstracted elsewhere in this issue.

Thirty-second Annual Report of Texas Station, 1919, B. Youngblood (*Texas Sta. Rpt. 1919, pp. 26*).—This contains a report of the director on the work of the station and the various substations, and a financial statement for the Federal funds for the fiscal year ended June 30, 1919, and for various State funds for the fiscal year ended August 31, 1919. The experimental work reported with rice and cotton is abstracted on page 229.

Thirtieth Annual Report of Washington Station, 1920, E. C. JOHNSON (*Washington Sta. Bul. 158 (1920), pp. 47*).—This contains the organization list, a report on the work and publications of the station during the year, and a financial statement for the Federal funds for the fiscal year ended June 30, 1920, and the remaining funds for the fiscal year ended March 31, 1920. The experimental work reported is for the most part abstracted elsewhere in this issue.

New farm facts: Annual report of the director for 1919–20, H. L. RUSSELL and F. B. MORRISON (*Wisconsin Sta. Bul. 323 (1920), pp. 98, figs. 38*).—This contains an account of the activities of the station, a list of the station publications of the year, and a financial statement as to the Federal funds for the fiscal year ended June 30, 1920. The experimental features not previously reported are for the most part abstracted elsewhere in this issue. A special feature is the insertion in the text of a number of brief general articles.

General index to Colorado Experiment Station publications, compiled by A. DILTS (*Colorado Sta. Bul. 263 (1921), pp. 69*).—This contains a combined subject and author index to Bulletins 1–249, Press Bulletins 1–58, annual reports from 1888 to 1918, inclusive, and three special river bulletins.

Monthly Bulletin of the Ohio Experiment Station (*Ohio Sta. Mo. Bul. 6 (1921), No. 3–4, pp. 33–64, figs. 7*).—This number contains several articles abstracted elsewhere in this issue and a brief note on potato diseases.

Monthly Bulletin of the Western Washington Substation (*Washington Sta., West. Wash. Sta. Mo. Bul. 9 (1921), No. 2, pp. 17–32, figs. 2*).—This number contains brief articles on the following subjects: Renewing the Lawn, by J. L. Stahl; Production of Silage Corn and Mangels, by M. E. McCollam; Anticipating Pasture Shortage, by H. E. McNatt; Chick Tricks, by Mrs. G. R. Shoup; Intestinal Roundworms in Poultry, W. T. Johnson; and Insect Pests of the Home Garden and Their Control, by A. Frank.

A dictionary of scientific terms, I. F. and W. D. HENDERSON (*London: Oliver and Boyd, 1920, pp. VIII+354*).—This dictionary gives the pronunciation, derivation, and definition of terms in biology, botany, zoology, anatomy, cytology, embryology, and physiology.

Elements of statistics, A. L. BOWLEY (*London: P. S. King & Son, Ltd.; New York: Charles Scribner's Sons, 1920, 4 ed., pp. XI+459, pls. 12, figs. 37*).—Part 1 of the present edition of this standard treatise deals with elementary statistical methods and is based upon similar material in the first edition published in 1901. On the other hand, part 2, Applications of Mathematics to Statistics, is practically a new discussion of frequency curves and the theory of correlation including partial and multiple correlation. Although the illustrative data are taken mainly from the field of economics, the needs of the experimenter are not neglected in the theoretical treatment.

The author believes that an elementary knowledge of infinitesimal calculus is necessary for the serious study of mathematical statistics. "This opinion is confirmed by the very loose reasoning often employed by writers who make too facile use of the standard deviation, of curves of frequency, and especially of the coefficient of correlation. . . . No one should attempt to measure correlation till he has studied the theory closely and critically."

NOTES.

Illinois University.—The legislature has granted appropriations aggregating $10,500,000 for the ensuing biennium. This is a material increase over the present appropriation, which had not been enlarged since 1910, although student enrollment had more than doubled and operating expenses greatly expanded.

Kansas College and Station.—H. B. Walker has been appointed head of the farm engineering department of the college, and has been succeeded as head of the rural engineering department of the extension division by Mark Havenhill. Other appointments include Paul L. Mann as assistant professor of the milling industry and E. S. Lyons, previously instructor in soils, as superintendent of the agronomy farm. G. A. Maxey, assistant professor of dairy husbandry, has resigned.

Louisiana State University.—As the result of action taken by the State constitutional convention, just adjourned, the university will receive $7,500,000 for new buildings and equipment. This sum has been set apart for the purpose from funds accruing from the newly established severance tax on oil and other natural resources. Plans are under way for the erection of the new buildings on a 2,000-acre tract near Baton Rouge.

The new constitution also provides a one-half mill tax, which it is estimated will yield approximately $1,000,000 per annum for the maintenance of the university.

Missouri Station.—Seven new projects have been started by the station during the past year. These include studies of (1) relation of food consumed to protein and energy retained in the carcass, (2) sunflower seed as a feed for fattening swine, (3) standards of growth for dairy cattle, (4) genetic analysis of maize, (5) morphological classification of the varieties of soy beans, (6) rate of growth of chicks under normal conditions, and (7) distribution of abortion infection in swine by positive reacting immune carriers.

The resignations are noted of T. E. Friedemann and O. E. Pollock as assistants in agricultural chemistry and field crops, respectively. Alva C. Hill has been appointed assistant in field crops.

Rutgers College.—The new horticultural building, a two-story brick structure, was recently dedicated. The principal address was made by F. A. Waugh of the Massachusetts College, who predicted the principal impending developments in horticultural practice as along marketing lines.

President W. H. S. Demarest has been granted a year's leave of absence, to be spent in part in compiling a history of the college.

North Dakota College.—O. A. Barton, formerly State club leader, has been appointed in charge of the poultry department, with Glen McIlroy as assistant.

Oregon College.—H. H. Gibson, professor of vocational and agricultural education in the University of Arizona, has accepted an appointment as head of the department of agricultural education.

Rhode Island Station.—Helena A. M. Tibbetts has resigned as assistant in animal breeding and pathology and has been succeeded by Mary E. Williams, a 1921 graduate of Simmons College. Robert L. Jones, a 1921 graduate of the Massachusetts College, has been appointed assistant in chemistry.

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EXPERIMENT STATION RECORD.

VOL. 45. SEPTEMBER, 1921. NO. 4.

At no period in the history of the experiment stations have changes come so rapidly in their administrative officers as in the past few years. A year ago it was reported that the directorship of practically half of the experiment stations had changed since 1914. During the current year ten more changes have been added to the list. This is an unusually large quota for a single year, and it includes several directors who have long held a prominent place in the annals of these institutions. The conspicuous character of their service and the change which their retirement makes in the roster of station officers are matters worthy of more than passing notice.

A list which includes such names as Jordan, Thorne, Woods, Duggar, and Rolfs reaches well-nigh back to the beginning of the American stations, and when there are added those of Knight, Harris, and Coulter of the more recent group, it will be evident what a single year has brought about in the station ranks. Three of these men have been associated with the experiment stations since their organization under the Hatch Act thirty-four years ago, and two were almost the last connecting link between the original State stations and the national system which grew out of them. Two others had been in the station work nearly or quite thirty years, while two more had served the stations for fourteen and seventeen years respectively.

The States affected by these changes are Alabama, Florida, Maine, Minnesota, New York, Ohio, Oklahoma, Utah, and West Virginia, together with the Virgin Islands. The directors involved in these changes will not in all cases be permanently lost to the interests of agricultural inquiry. Dean Thatcher, for instance, who left the Minnesota Station, has gone to the New York State Station to give his entire time to research. Others, although they have relinquished administrative positions, have not retired and are likely to join the forces elsewhere. While changes in the administrative force are to some extent inevitable with the passage of years, when they result from political or other unfavorable conditions they indicate that the stability of these high positions is not yet fully assured in all cases.

We are apt to give little thought to the beginning of things, and sometimes fail to realize the conditions through which the stations have come up to their present stage of development. We may easily overlook the large extent to which this development is the result of the vision and the influence of certain long-time leaders who have sought diligently to promote the ideals and work out the mission of the experiment stations, in a national sense as well as in their individual States.

As man is the fundamental factor in research, so he has been in developing this new type of institution on American soil, adapting it to its environment without sacrificing the essentials of its general character. Each State has in a sense been a problem in itself, but the example of certain ones and the wise counsel of prominent individuals has been a very large factor in leavening the whole and establishing definite policies. It is well to remember, therefore, the service of those whose influence has been large in realizing the high conception and the destiny of the American stations. To that end the conspicuous list of the year may be passed in review.

Prof. J. F. Duggar of Alabama began his station connection in 1890, as assistant director in South Carolina. He was for three years in editorial work on *Experiment Station Record*, then became agronomist at the Alabama Station, and director in 1903, holding that position for eighteen years. A thorough student and scholar of science, his inclinations were strong in the direction of research having a special bearing on crop production in the Southern States. In his devotion to the interests of that section and his clear vision of the ways and means for improvement, he never lost sight of the ultimate practical aim of experimentation, however technical it might be. He worked to such good purpose that he gained for himself recognition as one of the foremost agricultural authorities in the South, and a leading expert in the field of agronomy. He has been a resourceful and untiring worker who put his best into his work and never shirked responsibility. He has been strong in the councils of his State and in those of the southern stations as a whole.

Prof. P. H. Rolfs, with two short interruptions, had been connected with station work since 1891, and director of the Florida Station for fifteen years. These years marked a period of decided change and development in that station. Its work was systematized and directed along the channels of certain leading industries, and won much support and commendation. While Prof. Rolfs has severed his association with experimental work in this country, our loss will be the gain of a neighboring State in Brazil, where his experience and ability will be relied upon in establishing an institution for agriculture along American lines.

When the experiment station work in Connecticut was reorganized under the Hatch Act, Dr. C. D. Woods became chemist and vice-director of the Storrs Station, then in charge of Prof. W. O. Atwater. He took an important part in the investigations which the latter conducted, notably in human nutrition and the relation of legumes to nitrogen assimilation from the air. In the directorship of the Maine Station, dating from 1896, he followed one who had secured for himself and the station a high degree of confidence and recognition. These he was able to maintain and to develop the station work on sound fundamental lines. He believed in the power of research to supply the practical means of advance, and he sought to do the things that would endure. To that end he built up a corps of able investigators whom he stimulated and protected in holding to their problems. This, with the opportunity he sought for them and the large freedom of initiative he encouraged, placed the activities of the Maine Station on an unusually high plane and gave it a nation-wide reputation. His sudden removal after nearly a quarter century of service, at a time when he was seeking to provide for a line of study whose interruption had been threatened, is one of the tragedies of station administration from which it was hoped the system had become free.

Dr. H. G. Knight began station work in Wyoming in 1904 and had held the position of director since 1910, going to Oklahoma in 1918. His standards and his administrative ability enabled him to place the work of the latter station in a much stronger position. His work there was interrupted by his resignation, which, although voluntary, was due to unfortunate conditions which have frequently befallen that institution.

Dr. F. S. Harris had been for fourteen years in the station work in Utah, and for the past five years its director. He brought to his work sound scientific training and clear conceptions of the necessity for thoroughgoing inquiry as a safe basis for generalization. He left the station to accept the larger administrative position of president of the Brigham Young University.

Dr. John L. Coulter, an economist and the first of his specialty to head a station, had been dean and director in West Virginia since 1915. He leaves to become president of the Agricultural College in North Dakota.

When the United States took over the Virgin Islands, it found an experiment station on the island of St. Croix which had been established in 1910 under Danish auspices. It was organized by Dr. Longfield Smith, a graduate of the Universities of Edinburgh and Leipzig, who had been connected with the Department of Agriculture in Barbados, and he had remained at the head of the station from the time of its establishment. He was continued until the past summer, when at his own request he retired to engage in citrus growing in Florida.

A conspicuous figure in the Association of American Agricultural Colleges and Experiment Stations for many years has been the Director of the Ohio Experiment Station. This has been due to the man himself and to the prominence of the institution he represented, which was the first station to be established in the Central West. He was appointed director of the station in 1887, and had served continuously in that capacity for thirty-three years. He had previously been manager of the State university farm, where experimental work was carried on, but for several years prior to his appointment as director he had been engaged in agricultural journalism. It is interesting to recall that Prof. Thorne was present at the first meeting of representatives of the agricultural colleges and experiment stations at Washington in 1885, at which, as he has told us in his address as president of the association which grew out of that assembly, chief attention was given to the Cullen bill for a national system of experiment stations. Although that bill did not pass, the essentials of it, with minor changes, became the Hatch Act of 1887. The first convention of the Association of American Agricultural Colleges and Experiment Stations was held in that year, with attention naturally centering in the new measure. The only record of this first convention we owe to the notes which Prof. Thorne took and preserved as secretary. As he has pointed out, the Association was called into being by the movement for a national system of experiment stations, and gave its early attention to inaugurating and directing a new enterprise in the world.

Up to the time of the passage of the Hatch Act the Ohio Station had received about $5,000 a year. For the current year its appropriation is approximately $300,000, the largest of any of the stations. Its remarkable growth is a product of the constructive planning and leadership of its director, supported by a confident and appreciative Commonwealth.

It was through Prof. Thorne's initiative that the station was moved from the grounds of the University to a location where it could have adequate and permanent provision of land, and it was under his immediate supervision that the extensive series of field plats was laid out which has made the Ohio Station one of the leading exponents of plat experimentation.

Although he had not had opportunity for that broad and severe college training we now associate with the preparation of the investigator, Prof. Thorne has evidenced a true scientific mind, because his has been a truth-loving and a truth-seeking mind. To a large extent he may be said to be self-made in his knowledge and in his appreciation and understanding of science. Through all the years he has labored diligently for the unbiased truth that he might know it. He has been close to agricultural practice and anxious to give it material aid, but he has sought first of all the facts and their meaning, that he might have wisdom in their interpretation into practice. The breadth and liberality of his view is indicated by the development of his organization, building department upon department as the need for it became evident in working out the group of problems to which the station has addressed itself. The standards he has held up for himself and his staff have shown how deeply he was imbued with the spirit of science.

Despite the heavy burden of administrative responsibility resting upon him, Prof. Thorne has carried a remarkable amount of investigation in the field of soil fertility. For some time he has sought relief in retirement from the directorship in order that he might devote himself wholly to garnering in the product of these investigations, a request which was at length granted him last spring. This is a happy outcome, for no one is so well fitted as he to digest these findings and bring to light their teachings in the realm of fact and method.

Two quotations from Prof. Thorne's address as president of the Association of American Agricultural Colleges and Experiment Stations in 1916 illustrate the vision and purpose which have guided him in his thirty-three years of directorship. He said: "The agricultural experiment station is a necessary and indispensable complement to the college of agriculture, for the experiment station is both the crucible in which theories are tested and the fine gold of truth is separated from the dross of error, and the instrument of research by which further progress is made into the realm of the unknown." And again: "Science can not stand still. Each extension of the horizon of our knowledge only expands the boundary of the unknown, and makes yet more imperative the necessity for further research, and the institution which contents itself with present knowledge will soon find itself forgotten. . . . After all is said, it is to the soil and its secrets that we must turn for the material progress of the race; and when material progress ends the intellect will also stagnate."

Dr. W. H. Jordan, who retired in June, was one of the few remaining pioneers among the station directors who aided in founding and building the American system of agricultural research. He was the last of the group who bind the original State stations with the present national system.

The Maine fertilizer control and agricultural experiment station was established in March, 1885, and Dr. Jordan, a native son, was called to be director and chemist. At that time he was professor of agricultural chemistry in the Pennsylvania State College, and had laid out there the system of plat experiments with fertilizers which has been continued ever since without interruption, the present season concluding forty years. At the time the Maine Station was established there were only nine stations organized and in operation under definite State appropriations, although experimental work was carried on at a number of other colleges.

It was the day of small things, for most of the State stations had only a few thousand dollars appropriation in addition to the fertilizer funds and the sales of products. Dr. Jordan started his career as a station director with an appropriation of $5,000 a year, out of which the fertilizer control had to be maintained. He was, as he has said, his own stenographer, clerk, bookkeeper, and editor, as well as sharing in the analytical work of the laboratory. But in spite of this small beginning he made so strong an impression that he became one of the recognized leaders, and after eleven years was called to the directorship of the foremost station of the country in point of revenue, which had a high record of attainment. The appropriation of the New York State Station at that time was about $80,000, an amount which was more than doubled during his twenty-five years of administration. Although the beginning was so meagre, when Dr. Jordan retired after thirty-six years of directorship in these two stations, he left an institution which while holding true to its function had grown to an annual appropriation of more than $160,000 and a staff of some forty people.

The period of his activity covers the greatest period of development in the American stations, not only in point of revenue but in the growth of agricultural research. He stood consistently through the formative period of the stations for the high ideals and purposes which these institutions were to express. His voice was heard in no uncertain terms in setting forth these ideals, in defining the nature and essentials of research, in criticism of tendencies he believed to be injurious, and in constructive suggestion.

From the first, Dr. Jordan had a clear vision of the field and function of the experiment station as an institution for acquiring information through experiment and research. He contended that the Hatch Act established it "as a means of experimentation and research, and for no other purpose;" that to maintain otherwise was to distort the understanding of an experiment station and the idea fundamental to its organization as expressed in the word "experiment"; and that a station functioning chiefly as an instrument of popular instruction was an absurdity.

He was the champion of a strong organization for the stations, maintaining that although connected with an agricultural college the station should have a well-defined and independent individuality, that it was never intended that it should be in any sense an appendix to class room instruction, and that the director and leading members of the staff should be first of all workers for the station and give to its proper activities their highest thought and their best energies.

Speaking at the quarter-centennial of the establishment of the first station, in Connecticut, he made this strong appeal for the station director: "Above all, I plead for a station director who is that and nothing more. In the multitudinous duties of administration, in the broad relations which he should sustain with the agriculture of the State, in deciding upon the most useful lines of work, in the sympathetic attitude of encouragement, and if possible of inspiration, which he should maintain toward his associates, there is abundant opportunity for the full exercise of the largest ability and the most untiring energy. If there is any official in our land grant colleges other than the president who should not be halved, it is the station director."

With his understanding of the requirements of substantial investigation he likewise set forth the objection to dividing the time of station men to the extent common. He pleaded for the defense of the investigator in the uninterrupted use of his time on his problems, declaring that "in so far as the energies of this agency are devoted to efforts other than those of research, we are delaying the progress of agricultural knowledge." He maintained that "it is out of the question for college professors to be tied to the daily duties of instructing students and at the same time maintain a close, well informed, and broadly helpful relation to the needs and conditions of agricultural practice;" and again that "we face this fundamental and imperative fact, that a member of a station staff can not be an efficient investigator and engage to any considerable extent in popular instruction."

Since knowledge is a limiting factor in all human endeavor, and it is the primary function of the station to acquire that knowledge essential to agriculture, he made many an ardent plea for opportunity to do its work, and for protection of the station from demands which were outside its proper field. On more than one occasion he called attention to the distortion of the stations' function, the extent to which they had been "coerced in efforts that do not belong to them," and declared that "the greatest and most permanent acquisitions that have come to agriculture as an art during the past fifty years are the outcome of profound scientific study." Again, he explained that "agricultural practice has no greater need to-day than an enlarged vision through more and safer knowledge, and that a new truth may have vastly greater value than many volumes of pleasing addresses." It was an apt illustration of his in referring to the application of scientific facts that "it is easier to cut a diamond to its setting than it is to find it."

Dr. Jordan has helped us to understand what science is and what it is not, what the essentials are of scientific inquiry, and the distinction between research worthy of the name and other types of work. While admitting that purely practical and local experiments had brought farmers into sympathy with science as a means of progress, he drew the conclusion that "we should guard against centering an experiment around facts or conditions which are of mere local or temporary importance;" and he added that the literature was "already cluttered with so-called practical conclusions that in a brief time will be swept into the rubbish corner." He held it as fundamental to the largest success that experiments should "deal with matters of general and permanent utility;" and he reminded his hearers that the "contributions of note which have entered into the warp and woof of agricultural practice are those which have been proclaimed from the inner temple of science," and furthermore that "the discoveries of scientific truth which are to-day blessing the farmer in his daily toil are mostly those which have been reached through the severest and most searching investigations."

As a basic principle he contended that "the only way to uplift any industry is to develop among those who are engaged in it not only technical knowledge and skill, but intellectual and moral force." This led to his emphasis of the need of the farmer for understanding, and the need for developing not only the bare facts but the meaning of them, their purport, their relationships, in order to be intelligent about them. For he laid great stress on making the farmer independent in his thinking, freeing him from rules and blind formulas, and inculcating the ability to interpret results himself for his particular conditions.

Perhaps it was in the field of criticism that some of Dr. Jordan's most useful work was done. He preserved the attitude of scientific criticism toward his own work and that of his associates, for he sought sound truth and abhorred superficiality or hasty conclusions. He demanded the truth and he did not hesitate to question conclusions where the evidence was defective. His clear analysis of problems and the requirements for their solution was most helpful.

His frank exposure of what he conceived to be weaknesses in the stations, his vigorous comments on conditions and practices which ought to give way to higher standards, were made in no spirit of censoriousness but with a directness that expressed the force of his convictions. They came with a full understanding of the difficulties under which many of the institutions labored, but with no disposition to condone. He looked for progress, and he urged constant pressure in that direction, reminding his co-workers that in this most ambitious and extensive scientific effort of the day their ideals, intelligence, integrity of thought and ability, in things scientific, would be judged by the outcome of their labors.

To a considerable extent we have lacked in our agricultural work criticism which has been deliberate and searching, and tempered by the spirit of understanding. The freedom he exercised in that field was one of the large elements of his influence. But it sometimes brought on him the charge of being extreme and idealistic, of advocating ideals not practicable for the time and the place. On one occasion he anticipated such an objection by remarking that if the specifications he had outlined were unattainable "so much the worse for the prospect of scientific progress among us"; and he aptly added that when the temperature essential to the hatching of eggs in an incubator is unattainable the eggs do not hatch.

The influence of such a vigorous, clear-visioned character in the councils of the experiment stations for a period of thirty-six years can hardly be overestimated. It is apparent only after a review of the things he contended for and the course which development has taken. He has been a leader in the march of progress. He will be greatly missed in the meetings of the Association and in his personal relations with those engaged in agricultural research. All who have known him will join in the feeling expressed in the resolutions of the faculty of the Cornell College of Agriculture, that "he has richly earned the relief which retirement from active service brings," and will "wish him many years in which to enjoy the privileges of the contemplative life."

RECENT WORK IN AGRICULTURAL SCIENCE.

AGRICULTURAL CHEMISTRY—AGROTECHNY.

Treatise on general and industrial organic chemistry, I, E. MOLINARI, trans. by T. H. POPE (*Philadelphia: P. Blackiston's Son & Co., 1921, 3. ed., rev. and enl., pp. XV+456, figs. 253*).—This is a translation of the third Italian edition of this treatise, supplanting the translation of the second edition previously noted (E. S. R., 30, p. 309).

The chemistry of agriculture, C. W. STODDART (*Philadelphia: Lea & Febiger, 1921, 2. ed., rev., pp. X+17-340, pl. 1, figs. 83*).—In preparing the second edition of this text on general agricultural chemistry (E. S. R., 32, p. 501), the summary at the end of each chapter has been replaced by a list of suggestive questions by M. W. Lisse on the subject matter of the chapter. New sections have been added on fertilizer materials showing the development of the potash resources of the country and of synthetic nitrogenous fertilizers, and the subject matter in general has been thoroughly revised.

Industrial and agricultural chemistry in the British West Indies, with some account of the work of Sir Francis Watts, Imperial Commissioner of Agriculture, C. A. BROWNE (*Jour. Indus. and Engin. Chem., 13 (1921), No. 1, pp. 78-83, figs. 4*).—This article continues the report of the author's visit to the British Colonies of tropical America (E. S. R., 41, p. 501). The industries discussed are sugar and cane sirup manufacture, cacao, citric acid, essential oils, and rubber. A tribute is paid to Sir Francis Watts, Imperial Commissioner of Agriculture for the British West Indies, to whom the introduction of modern methods of sugar manufacture and improvement in other agricultural industries are ascribed.

The thermal decomposition of gaseous nitrogen pentoxid.—A monomolecular reaction, F. DANIELS and E. H. JOHNSTON (*Jour. Amer. Chem. Soc., 43 (1921), No. 1, pp. 53-71, figs. 5*).

The photochemical decomposition of nitrogen pentoxid, F. DANIELS and E. H. JOHNSTON (*Jour. Amer. Chem. Soc., 43 (1921), No. 1, pp. 72-81*).

The polysaccharids, H. PRINGSHEIM (*Die Polysaccharide. Berlin: Julius Springer, 1919, pp. V+108*).—This monograph deals largely with cellulose chemistry in relation to soils and to the recent developments in connection with the manufacture of substitute feeding stuffs. References to the original literature and tables of analytical data on the composition of straw and cellulose products hydrolyzed by different methods are included. The book also contain chapters on starch, glycogen, dextrin, inulin, hemicelluloses, and nitrogen-containing polysaccharids.

The preparation of rhamnose, C. F. WALTON, JR. (*Jour. Amer. Chem. Soc., 43 (1921), No. 1, pp. 127-131*).—A method devised at the Bureau of Chemistry, U. S. Department of Agriculture, for preparing rhamnose from flavin, a commercial product rich in quercitrin, is summarized as follows:

"The flavin is hydrolyzed by boiling for 30 minutes with 10 parts of water and 0.5 per cent sulphuric acid. The residue is washed free from sugar and the combined filtrates are neutralized with barium carbonate, decolorized, and concentrated under diminished pressure to a density of about 40 per cent solids. The inorganic impurities are now precipitated by the addition of ethyl alcohol, and the crystallization is readily accomplished by concentrating the filtrate to a density of 70 to 80 per cent solids. The yield of rhamnose is 20 to 25 per cent of the weight of flavin taken."

The production of volatile fatty acids by bacteria of the dysentery group, H. F. Zoller and W. M. Clark (*Jour. Gen. Physiol., 3 (1921), No. 3, pp. 325–330, fig. 1*).—In the course of an investigation at the research laboratories of the Dairy Division, U. S. Department of Agriculture, of the bacteria of the dysentery group, determinations were made of the volatile fatty acids produced by these bacteria under different conditions. The results of the study are summarized as follows:

"A close agreement exists among all the organisms studied in the total quantity of volatile fatty acids produced and in the ratio of formic to acetic, under aerobic conditions and in the presence of 1 per cent of glucose. When grown upon peptone alone, with free access of air to the cultures, volatile fatty acids are produced in appreciable quantities, although the reaction of the solution has gone more alkaline as shown by colorimetric pH tests. Formic acid is not found, but in its place we obtain propionic acid.

"Upon exhaustion of air from the nonsugar medium the bacteria again produce formic acid, and in addition some butyric. This is true for both Shiga and non-Shiga cultures. The reaction is distinctly more acid. The presence of glucose in the medium from which the air has been pumped furnishes a condition which provokes about the same type and degree of fermentation that operates in the glucose medium bathed in air at atmospheric pressure.

"The enormous quantity of formic acid produced by these bacteria may play a significant part in the digestive disturbances and toxic symptoms accompanying their infection of the human intestinal tract."

An analysis of otoba butter, W. F. Baughman, G. S. Jamieson, and D. H. Brauns (*Jour. Amer. Chem. Soc., 43 (1921), No. 1, pp. 199–204*).—This contribution from the Bureau of Chemistry, U. S. Department of Agriculture, consists of an analysis of the fat expressed from the fruit of *Myristica otoba* and variously known as otoba butter, American nutmeg butter, American mace butter, and otoba wax.

The fat, which has long been used in Colombia, South America, as a medicament for skin diseases of domestic animals, is said to be a white butter-like substance with a nutmeg-like odor in the fresh state, while on standing a brown color and disagreeable odor develop. Chemical analysis showed it to be a mixture of a volatile or essential oil, a fixed oil, and unsaponifiable matter apportioned as follows: Glycerids of lauric acid 15.1, myristic acid 52.2, palmitic acid 0.2, and oleic acid 3.9 per cent; essential oil, chiefly sesquiterpenes, 9.3 per cent; and unsaponifiable constituents, consisting of otobite and iso-otobite ($C_{20}H_{20}O_4$) 9.4 and a viscous mass 11 per cent.

The chemistry of vitamins, A. Seidell (*Jour. Indus. and Engin. Chem., 13 (1921), No. 1, pp. 72–75*).—In this lecture, delivered before the Chemical Society of Washington, D. C., the author reviews the experimental work on the chemical nature of vitamin B, or the antineuritic water-soluble vitamin, and discusses the probable nature of vitamin activity, particularly from the point of view of similarity in action of vitamins and enzyms.

Colorimetric studies of tryptophan (*Biochem. Ztschr., 109 (1920), pp. 103–164*).—Three papers are presented.

I. *The tryptophan content of blood serum and milk,* O. Fürth and E. Nobel (pp. 103–123).—In this paper the authors review briefly the literature on tryptophan determinations, and report the results of an application of the method of Voisenet[1] to the determination of tryptophan in blood serum and in human and cow's milk. The technique of the method is as follows:

Two cc. of a standard 0.1 per cent solution of pure tryptophan in 2 per cent sodium fluorid is measured into a 25 cc. graduate, 1 drop of 2.5 per cent formaldehyde solution and, after shaking, 15 cc. of concentrated HCl are added and the whole mixed by pouring into another graduate, after which 10 drops of 0.05 per cent solution of sodium nitrite and sufficient concentrated HCl are added to make the volume up to 20 cc. After mixing by pouring back and forth from one graduate to another and allowing to stand for 5 or 10 minutes, the solution is compared in a Duboscq colorimeter with a solution of the protein to be examined which has been treated in the same manner. In case the tryptophan content is entirely unknown the nitrite solution should be added drop by drop until the maximum color is produced.

As determined by this method, normal horse serum was found to have a tryptophan content of from 0.2 to 0.4 per cent. On fractionation of the serum into globulin and albumin, the serum was found to contain from 1.2 to 1.5 per cent of tryptophan and the globulin from 4.1 to 4.7 per cent. The casein of cow's milk and the protein of the whey after souring each furnished about 2 per cent of tryptophan. The protein of human milk contained from 3.4 to 6.8 per cent. This higher content of tryptophan in human milk is suggested as accounting in part for its more favorable growth-promoting character.

II. *Methodical investigation of the colorimetric tryptophan determination with the Voisenet reaction, together with its application to proteins and organs,* O. Fürth and F. Lieben (pp. 124–152).—This paper reports in detail the systematic study of the Voisenet reaction leading to the development of the technique noted above.

The reaction is sensitive to 1:50,000 tryptophan, and is considered specific for tryptophan except that indol yields a somewhat similar color change. A 0.01 per cent alcohol-water solution of gentian violet is recommended as a fairly good permanent standard for comparison. Difficultly soluble and coagulated proteins should be brought into solution in 20 to 30 per cent sodium hydroxid before making the test.

The tryptophan content of various proteins, as determined by this method, is given as follows: Fibrin 5.3 per cent, Witte's peptone 5.3, serum globulin 4, serum albumin 1.3, human milk protein 6.3, casein from cow's milk 2, keratin 1.2, and egg albumin, edestin, and muscle protein from 2 to 3.5 per cent. The tryptophan content of normal human organs lay between 0.1 and 0.6 per cent. The liver, spleen, and thyroid gland were especially rich and the urine especially poor in tryptophan.

III. *The splitting-off of tryptophan during the digestive process,* O. Fürth and F. Lieben (pp. 153–164).—The method described above was utilized to determine the extent of tryptophan formation from proteins during artificial digestion, the free tryptophan being separated from the bound by precipitation with phosphotungstic acid. On digestion of fibrin with trypsin with careful regulation of the H-ion concentration by means of phosphate, acetate, or borate buffers, not more than one-third or at the most two-thirds of the tryptophan was split off in the course of a week. The authors conclude that there is no ground for assuming that tryptophan, like tyrosin, is liberated from the protein in the early phases of digestion, but that it is given off gradually like the other amino acids.

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[1] Bul. Soc. Chim. Paris, 3. ser., 33 (1905), pp. 1198–1214.

The determination of tryptophan in proteins, P. THOMAS (*Ann. Inst. Pasteur, 34 (1920), No. 10, pp. 701–708*).—The author discusses various methods for determining tryptophan in proteins, and describes a modification of a method by Herzfeld[2] which depends upon the blue color formed by the action on tryptophan by *p*-dimethylaminobenzaldehyde in the presence of hydrochloric acid.

In the modified technique 0.4 gm. of the very finely divided product is dissolved in 200 cc. of 0.5 per cent Na_2CO_3 and to this is added 0.1 gm. of active pancreatin, 5 cc. of chloroform, and 5 cc. of toluene. After incubating the mixture at 37° C. for 5 or 6 days, 50 cc. of the solution is removed and treated with 10 cc. of a reagent made by dissolving 20 gm. of *p*-dimethylaminobenzaldehyde in 500 cc. concentrated HCl and 500 cc. of water, and the whole diluted to 100 cc. with concentrated HCl. After standing in the light for 48 hours, the color is compared with that developed in a standard of pure tryptophan similarly treated and a second comparison made at the end of 58 to 60 hours.

The content of tryptophan in casein as determined by this method was found to be from 1.7 to 1.8 per cent.

The determination of H-ion concentration by the colorimetric method and an apparatus for rapid and accurate work, E. VAN ALSTINE (*Soil Sci., 10 (1920), No. 6, pp. 467–478, pl. 1, figs. 2*).—The author describes a color comparator for H-ion concentration determinations by the indicator method, which is said to have been in satisfactory use at the New Jersey Experiment Stations for more than a year in the rapid determination of H-ion concentrations ranging in pH values from 2 to 9.

The apparatus, which is adapted for use with the double tube standard suggested by Barnett and Chapman (E. S. R., 39, p. 9) and improved by Gillespie (E. S. R., 43, pp. 11, 211), consists of an eyepiece supported in a frame so constructed that wooden blocks holding the color tubes can be made to slide in it before the eyepiece, bringing the color tubes successively into view. One block holding the tubes of standard colors with known pH values is passed before one section on the eyepiece, while another block holding tubes containing solutions of unknown pH values is passed before the other section. If double tube standards are used the blocks are made to accommodate two rows of tubes. The tubes used in the apparatus are screw-cap homeopathic vials about 15 mm. in outside diameter and 46 mm. high, which are used open for the unknown solution and tightly sealed for the standard.

To determine the concentration of indicator to be used in the case of the indicators of the Clark and Lubs series, a graph has been constructed that gives the percentage dissociation of the indicators for different pH values. This graph shows not only the percentage of indicator which is in the form giving the acid and alkaline colors when single-tube standards are used, but also the percentage of total indicator in both tubes of each pair that should be placed in each of the tubes when double tube standards are used and equal amounts of solution and indicator are placed in each tube.

Electric oven for rapid moisture tests, G. L. SPENCER (*Jour. Indus. and Engin. Chem., 13 (1921), No. 1, pp. 70–72*).—The oven described, which was designed for rapid moisture tests in sugar work, is essentially a device for conveying a large volume of heated air through a capsule containing the material to be dried. The capsules are of metal, the bottom being closed with monel metal filter cloth through which the air can pass, but which retains very fine powders. The capsules rest on openings over an annular channel leading to the vacuum pump or steam ejector system and containing a heating element consisting of spiraled resistance wire wound over a core. The system is placed in the oven's drying chamber, thus reducing radiation loss. In series connection with the heating element are a sliding contact rheostat for temperature control and an electric time switch which can be adjusted for the desired drying period.

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[2] Biochem. Ztschr., 56 (1913), No. 3, pp. 258]266.

Comparative tests with the new and old type ovens indicate that the moisture can be as completely removed from raw sugar in the new oven by heating at 105° C. for 20 minutes as in the usual types of electric oven by heating to the same temperature for over 3 hours. In addition to the saving of time there is considered to be less danger of decomposition of the material during desiccation in the new oven. Cane bagasse may be dried in the new oven at from 130° to 140° without appreciable decomposition.

A study of the determination of potassium as the perchlorate, and the separation from sodium, etc., R. L. MORRIS (*Analyst, 45 (1920), No. 535, pp. 349–368; abs. in Chem. Abs., 15 (1921), No. 1, p. 39*).—This is a critical discussion of various modifications of the perchlorate method of determining potassium in the presence of sodium, magnesium, calcium, iron, and aluminum compounds and of citric and tartaric acid.

The procedure adopted as the result of this study is essentially that of Gooch and Blake.[3] The solution of the salt is evaporated with 20 per cent $HClO_4$ to dryness (or to a paste if magnesium compounds, phosphoric acid, or organic acids are present), and the residue is treated with 10 cc. of a wash liquid consisting of 100 cc. of 98 per cent alcohol and 1 cc. of perchloric acid. If sodium is present the mixture is allowed to stand for 15 minutes with occasional stirring and the liquid finally decanted through a weighed Gooch crucible containing asbestos. The beaker containing the residue from the first decantation is placed on top of the air oven until the alcohol is evaporated, after which the residue is dissolved in a minimum amount of boiling water and again evaporated to dryness. The treatment with 10 cc. of wash liquid and decantation is repeated, the residue transferred to the crucible, and a measured volume of wash liquid added from a pipette in small portions to complete the washing. If potassium only is present, the precipitate is rinsed directly into the crucible with a measured quantity of the wash liquid. The crucible is then dried for an hour at 130 to 150° C., cooled for an hour in the desiccator and weighed, after which 2 or 3 cc. more of the wash liquid is passed through the filter and the drying and weighing repeated until successive weighings do not vary by more than 0.1 to 0.2 mg.

Data are included on the results obtained in the development and use of this technique, and a note is appended on details and criticism of the perchloric method as officially prescribed in Great Britain as an alternative for the platinic chlorid method of determining potassium in fertilizers.

New quantitative method for the determination of bromin, G. HARTWICH (*Biochem. Ztschr., 107 (1920), No. 4–6, pp. 202–206; abs. in Chem. Abs., 15 (1921), No. 1, p. 101*).—A method of determining bromin in urine or other organic fluids in which it may occur in minute amounts is described, and data are presented on its reliability. The method is essentially as follows:

The urine, ashed with sodium carbonate, is treated with sulphuric acid until the evolution of CO_2 ceases, after which free chlorin is added in small amounts and the liberated bromin is shaken out with chloroform. Each portion of chloroform is removed to a watch glass and tested with acid fuchsin, and the extraction is continued until the violet color imparted by the bromin to the chloroform in the presence of fuchsin is no longer obtained. A control of chlorin water and potassium iodid is titrated with N/10 $Na_2S_2O_3$ to determine the titer of the chlorin.

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[3] Amer. Jour. Sci., 4. ser., 44 (1917), No. 263, pp. 381–386.

A new apparatus for determining the catalase content of milk, A. MACHENS and F. CORDES (*Milchw. Zentbl., 50 (1921), No. 3, pp. 25–27, fig. 1; also in Ztschr. Fleisch u. Milchhyg., 31 (1921), No. 9, pp. 115–117, fig. 1*).—The apparatus described and illustrated in this paper consists of an ordinary flask or bottle joined near the top by means of a glass tube provided with a three-way stopcock to a second receptacle shaped somewhat like a U tube, one arm of which is approximately the same size and shape as the first flask and the other shorter and of smaller dimensions but extended by means of a 12 or 15 cc. tube graduated in cubic centimeters. In operation 15 cc. of milk is placed in the first flask and sufficient water in the second to bring the level to the zero mark on the graduated tube. The apparatus, open to the air, is placed in the incubator at 37° C. for 15 minutes, after which the stopcock is turned to close the connection between the two flasks. Five cc. of 1 per cent H_2O_2 solution is then added to the milk and the flask corked and shaken, after which the apparatus is again placed in the incubator and the stopcock opened. After the action has ceased, the amount of gas evolved is measured by the height of water in the graduated tube.

Conservation and analysis of milk samples preserved by dichromate, G. HINARD (*Ann. Falsif., 13 (1920), No. 142–143, pp. 463–474*).—This is a detailed discussion of the effect of added dichromate upon various milk determinations, leading to the conclusion that modifications in all the constituents take place after a short time to such an extent as to render the results invalid. Reference is made to the discussion of the same subject in recently noted papers by Marchadier and Goujon (E. R. S., 42, p. 112), Hildt (E. S. R., 43, p. 14), and Magnier de la Source (E. S. R., 44, p. 204).

A butter hydrometer, A. BRUNO (*Ann. Falsif., 13 (1920), No. 144–145, pp. 543–545, fig. 1*).—A novel device for the rapid determination of moisture in butter is described. This consists of a hydrometer surmounted by a small platform on which can be placed a metal cup to contain the butter sample. The hydrometer is so weighted that when placed in a cylinder of distilled water the zero mark of the scale is at the level of the water when the cup resting on the platform carries a weight of 5 gm. In operation sufficient butter is introduced into the cup to bring the zero mark to the level of the water. The cup is next removed and heated over a small flame with careful manipulation until the moisture is driven off as noted by the sudden darkening in color. It is then replaced on the platform and the point to which the hydrometer sinks is read on the scale, which is graduated into 20 divisions each of which corresponds to 1 gm. of water for 100 gm. of butter. No data are given as to the accuracy of the method.

The Bömer method for the detection of suet in lard, VITOUX and C. F. MUTTELET (*Ann. Falsif., 13 (1920), No. 146, pp. 593–601*).—This is the first of a series of studies on the application of the Bömer procedure (E. S. R., 32, p. 801) for detecting the presence of suet in lard by means of the differences in melting point of crystals of the pure glycerids and of the fatty acids obtained from them by saponification. The results obtained are interpreted from the fact that α-palmito distearin, the principal component of lard, melts at 68.5° C., β-palmito distearin, the corresponding component of beef fat, at 63.3°, and the mixture of fatty acids obtained by saponification of the two at 63.2°. For comparison the expression 2 G—A is used where G=the melting point of the glycerids and A of the fatty acids.

An examination by this method, the technique of which is described in detail, of pure pork fat from different parts of the animal and of commercial lard of French origin, has shown that for all samples the value 2 G—A is equal to or higher than 68. This value is consequently set as the minimum limit for unadulterated lard.

A microdetermination of calcium in blood, serum, and other organic substances, D. J. DE WAARD (*Biochem. Ztschr., 97 (1919), No. 3–5, pp. 176–185, fig. 1*).—The method consists in ashing in a platinum crucible from 0.5 to 1.5 cc. of blood to which a little concentrated hydrochloric acid has been added to facilitate the ashing, dissolving the ash in a few drops of dilute hydrochloric acid, transferring the solution by means of a capillary pipette to special centrifuge tubes, and washing out the pipette with a few drops of the acid. The tube is placed in a boiling water bath and the calcium precipitated as oxalate by means of half saturated ammonium oxalate solution, followed by a little ammonia and then acetic acid until the solution smells strongly of the acid on shaking. After cooling, the precipitate is separated by centrifuging and is then dissolved in about 0.3 cc. of dilute HNO_3, 1:1, heating on the water bath at 50° C. The solution is finally titrated with N/100 potassium permanganate, using a burette delivering 0.01 cc. drops and finishing the titration with a capillary pipette.

Direct microcalcium determination in serum, D. J. DE WAARD (*Biochem. Ztschr., 97 (1919), No. 3–5, pp. 186–188*).—Further study of the above method has shown that it is possible to precipitate all of the calcium of blood serum as pure calcium oxalate without previously ashing the serum.

The routine determination of creatinin and acetone in urine, H. J. GOECKEL (*Jour. Lab. and Clin. Med., 6 (1921), No. 6, p. 338*).—A routine clinical test for creatinin and acetone in urine is outlined as follows:

To each of a series of test tubes containing 5 cc. each of urine is added 10 drops of a saturated aqueous solution of sodium nitroprussid, followed by sufficient NaOH solution to produce the maximum intensity of color. A normal or high creatinin content is indicated by a dense cherry red color and a low content by a paler shade of red. On adding glacial acetic acid to each tube the urine returns to its normal color when the creatinin content is low, and to different shades of green, with varying amounts of creatinin, if acetone is absent. If acetone is present, various shades of red are produced.

Notes on the U. S. Government method of determining phenols in sheep dips, K. B. EDWARDS and G. A. FREAK (*Jour. Soc. Chem. Indus., 39 (1920), No. 23, pp. 326T, 327T*).—Attention is called to the method described by Chapin (E. S. R., 20, p. 420) for determining phenols in sheep dips by distilling the acidified dip with steam, dissolving the phenols in benzene, and finally shaking them out in 1:3 NaOH and measuring the increase in volume of the alkaline solution. Exception is taken to the assumption that, for mixtures of phenols ordinarily occurring in commercial cresylic acid and in the grades of coal tar creosote oils commonly used in making dips, the average coefficient weight of phenols divided by volume increase of NaOH is unity. Determinations are given of this coefficient for phenols, the three cresols, and cresylic acid fractions boiling at different temperatures.

The results reported show that the coefficient varies with the nature of the phenols, ordinary phenol showing an excess of 8 per cent and *p*-cresol a deficiency of 2.5 per cent. It is pointed out that the use of this method for evaluating cresylic creosotes and cresylic acids bought for sheep dips introduces a serious error, tending to indicate, in the case of cresylic acid having a large percentage of *o*-cresol, a purity from 4 to 6 per cent below its true content of phenols.

Determination of invert sugar in the presence of sucrose by Bruhns' method, P. BEYERSDORFER (*Ztschr. Ver. Deut. Zuckerindus., 1920, No. 773, II, pp. 259–271; abs. in Jour. Soc. Chem. Indus., 39 (1920), No. 15, p. 554 A*).—This is a discussion of Bruhns' method of determining invert sugar (E. S. R., 43, p. 314), with a comparison of results obtained on pure sugar and molasses by this and other methods.

An inherent error in certain modifications of the Clerget method of double polarization, C. A. BROWNE (*La. Planter, 66 (1921), No. 7, p. 109*).—The author discusses the validity of the modification of the Clerget method developed by Jackson and Gillis (E. S. R., 44, p. 413).

The application of the Clerget method to dilute sucrose solutions, R. F. JACKSON and C. L. GILLIS (*La. Planter, 66 (1921), No. 9, pp. 141, 142; also in Facts About Sugar, 12 (1921), No. 10, pp. 190, 191*).—A reply to the above.

A few observations upon the Clerget modification of neutral polarization, C. A. BROWNE (*La. Planter, 66 (1921), No. 11, pp. 171, 172, fig. 1; also in Facts About Sugar, 12 (1921), No. 12, pp. 230, 231, 234, fig. 1*).—A further discussion of the Jackson-Gillis modified Clerget method in reply to the above.

Manufacture of sugar cane [sirup] so as to prevent crystallization and fermentation, J. K. DALE and C. S. HUDSON (*Fla. Dept. Agr. Bien. Rpt., 16 (1919–20), pt. 1, pp. 204–213, fig. 1*).—A method devised at the Bureau of Chemistry, U. S. Department of Agriculture, for manufacturing sugar cane sirup with a water content of less than 20 per cent and that will not crystallize or ferment on standing is described briefly.

The principle of the method is the transformation of a large part of the crystallizable sucrose into invert sugar by the action of invertase. The cane juice from the mills or clarifiers is first evaporated in any type of evaporator to a density of 20° Baumé, after which the sirup is run into tanks and cooled to 140° F. and the invertase added in the proportion of 3 parts of invertase solution to 100 of the sirup. After standing over night the sirup is again evaporated to a Baumé reading of 36 to 37° in the boiling sirup or 42° after cooling to ordinary temperature.

Chlorin balance during the manufacture of sugar and the content of chlorin in the sugar beet, É. SAILLARD (*Compt. Rend. Acad. Sci. [Paris], 172 (1921), No. 5, pp. 283, 284*).—Completing the study of the distribution of the various constituents of sugar beets in the products of sugar manufacture (E. S. R., 43, p. 206), data on the chlorin distribution are presented. The average content of chlorin in the beet itself was 0.016 and in the molasses 0.3 per cent. Of the chlorin originally present in the beet 80 per cent passes into the molasses and 19 per cent remains in the diffusion residue, with an undetermined loss of 1 per cent. In the plant itself the content of chlorin was highest (about 1.8 per cent) in the stalks. The entire plant showed an average of about 1.2 gm. of chlorin for 100 gm. of sugar.

Report of committee on manufacture of sugar and utilization of by-products, W. VON H. DUKER ET AL. (*Hawaii. Sugar Planters' Assoc., Proc., 39 (1919), pp. 216–240*).—This report consists of an outline of developments and improvements in the manufacture of sugar in Hawaii during 1918–19, as embodied in reports from plantation managers.

The hydrogenation of oils and the manufacture of hydrogenated fats, O. BÄNNINGER (*Schweiz. Chem. Ztg., 1921, No. 1, pp. 1–11*).—The author discusses the theoretical and practical phases of the manufacture of hydrogenated oils.

Paint bulletin (*North Dakota Sta. Paint Bul., 1 (1919), No. 7, pp. 113–138, figs. 2*).—This special paint bulletin consists of the following papers:

A study of the fatty acids obtained from varnish oils and varnishes, II, W. T Pearce (pp. 113–115).—In continuation of the study previously noted (E. S. R., 39, p. 613), the results are reported of the application of various tests to the fatty acids obtained from varnish oils and varnishes. The iodin number was found to be qualitatively useful for cases where soy bean or cottonseed oil was added to linseed or menhaden oil, but worthless for quantitative estimation. The odor served to detect menhaden oil when present in amounts as large as 20 per cent and China oil to the extent of 40 per cent. The concentrated H_2SO_4 spot test gave a characteristic begonia leaf coloration with pure linseed oil and a yellowish green fluorescence with large amounts of soy bean oil. The hexabromid test gave excellent qualitative and semiquantitative results detecting the presence of menhaden oil in amounts of 10 per cent or above.

The wearing quality and physical tests of several exterior varnishes compared with their chemical analysis, W. T. Pearce and E. V. Ladd (pp. 116–129).—The results are reported of a number of physical tests, chemical analyses, and service tests of several exterior, interior, and floor varnishes. As these studies are to be continued, no definite or final conclusions have as yet been drawn.

Soy bean investigation, C. Ladd (pp. 130–138).—This paper supplements the data on soy bean oil in Bulletin 118 from this station (E. S. R., 36, p. 206) by similar data on the composition of the oil obtained from soy beans of the 1915 and 1916 crops and of crops grown in 1918 from the seeds of 1916, the seeds in many cases being grown in different localities. A change in locality was found in some cases to alter the iodin value of the oil. In general beans giving a certain iodin number in one locality showed a decided increase in iodin number when grown in a colder climate and vice versa. An increase or decrease in iodin value appeared to have no consistent effect on the oil content of the bean, nor did the oil content affect the iodin number.

Glue, gelatin, and their allied products, T. Lambert (*London: Charles Griffin & Co., Ltd., 1920, 2. ed., pp. XII+153, figs. 25*).—Of particular interest in this reference book on the glue and gelatin industry is the chapter on residual products, in which are given the methods of manufacture, composition, and particular use of various fertilizers prepared from skin, fish, and bone residues and from leather waste. The methods of preparing calcium phosphate and bone ash as by-products of the gelatin industry are described.

METEOROLOGY.

Local forecast studies—summer rainfall, T. A. Blair (*U. S. Mo. Weather Rev., 49 (1921), No. 4, pp. 183–190, pls. 2, fig. 1*).—In this article "observations at Dubuque, Iowa, at 7 a. m., ninetieth meridian time, for June and July, for the 20-year period, 1901 to 1920, inclusive, are tabulated with reference to the occurrence of precipitation within the following 12 and 24 hours, and classified according to the following elements: (1) Height of barometer, reduced to sea level, (2) change in height of barometer during past 12 hours, (3) change in temperature during past 24 hours, (4) amount of cloudiness, (5) relative humidity. A further classification according to (1) wind direction, and (2) kind of clouds is based on a 30-year period for the four months, May to August, inclusive.

"The results are shown in a series of tables and curves, based on the relation which the number of observations followed by rain within 12 or 24 hours bears to the total number of observations within the group. These tables and curves are intended to show the more important relationships existing between the data of the morning observation and the rain frequency during the following 12 and 24 hours, and it is suggested that a series of simple classifications, such as these, could be made at numerous stations throughout the United States, and would furnish material of much value."

The data used in this study showed the total probability of rain in 12 hours, under all conditions, to be 0.31. With a falling barometer the probability was increased about 10 points, except when the barometer was high. In this case it seemed less likely to rain with falling than with rising pressure. With a cloudy sky as well as a falling barometer the chances of rain in 12 hours increased from 20 to 40 points, ranging from 83 per cent with a low barometer to 33 per cent with a high barometer. The least probability of rain was connected with a falling temperature accompanied by clear weather and a rising barometer. There was considerable increase in rain probability with high humidity and a less marked decrease with low humidity.

Seasonal forecasting of precipitation—Pacific coast, A. J. HENRY (*U. S. Mo. Weather Rev., 49 (1921), No. 4, pp. 213–219, figs. 2*).—In this article an effort is made to discover from the available observational material "the true nature of the weather phenomena associated with years of heavy and years of light precipitation on the Pacific coast."

It is stated that the data show clearly that "the distribution of precipitation in Pacific Coast States is not, as a rule, of the same order of intensity. Indeed, fairly heavy precipitation in Washington and Oregon may be associated with deficient rainfall in California, and vice versa. The physical grounds for the difference in distribution are next sought. Three classes of seasonal distribution are distinguished, and these in turn are discussed with reference to their probable causes.

"The conclusion is reached that a knowledge of the pressure distribution over the northeastern portion of the Pacific Ocean and the Canadian Northwest affords the most hopeful avenue of approach to a rational solution of the problem."

The effect of vegetative evaporation on the rate of seasonal temperature changes, R. H. FINCH (*U. S. Mo. Weather Rev., 49 (1921), No. 4, pp. 206–209, fig. 1*).—Data are given in this article which show that "the evaporation of water transpired from vegetation causes a definite local cooling. An attempt to show that vegetative evaporation affects large areas is made by comparing spring average daily temperature curves of continental stations in arid and humid regions. Four figures are given showing a flattening in such curves for the stations in humid regions with less flattening, or none at all, for the stations in arid regions. It is pointed out that several factors, among them the control of weather by 'highs' and 'lows,' tend to obscure departures from a smooth curve caused by vegetative evaporation, but the evidence seems to indicate that vegetative evaporation has an appreciable effect."

The artificial control of weather, N. SHAW (*Abs. in Met. Mag.* [*London*], *56 (1921), No. 663, pp. 60–63; also in U. S. Mo. Weather Rev., 49 (1921), No. 4, pp. 244–246*).—The author's general conclusion is that "in the open air the ordinary inexorable laws which control the behavior of the atmosphere . . . have such enormous masses of energy in the form of warmth and water vapor in reserve that our own little reserves are not equal to making any serious impression on the course of nature."

Applied climatology in California, A. H. PALMER (*U. S. Mo. Weather Rev., 49 (1921), No. 4, pp. 219–223*).—The practical applications of California climaby C. E. P. Brooks; The Secular Variations of Climate, by J. Paraskévopoulos; Frost and Fruit in Southern Ohio in 1917 (illus.), by W. H. Alexander (see p. 320); Cold Air Prevents Severe Freeze, by A. M. Hamrick; Mapping the Ocean of Air, by C. E. P. Brooks; Progress in Making Free-air Pressure and Wind Charts (illus.), by C. L. Meisinger; Distribution of Weather Information, Forecasts and Warnings by Naval Radio for the Benefit of Aviation and Marine Interests; Lightning Explodes Tree and Digs Trenches (illus.), by A. F. Stevens; and Unusual Lightning, by R. E. Horton.

Climatological data for the United States by sections (*U. S. Dept. Agr., Weather Bur. Climat. Data, 7 (1920), Nos. 11, pp. [204], pls. 4, fig. 1; 12, pp. [209], pls. 4, fig. 1*).—These volumes contain brief summaries and detailed tabular statements of climatological data for each State for November and December, 1920, respectively.

Meteorological observations at the Massachusetts Agricultural Experiment Station, J. E. Ostrander, H. W. Poole, and A. G. Lindskog (*Massachusetts Sta. Met. Buls. 389–390 (1921), pp. 4 each*).—Summaries of observations at Amherst, Mass., on pressure, temperature, humidity, precipitation, wind, sunshine, cloudiness, and casual phenomena during May and June, 1921, are presented. The data are briefly discussed in general notes on the weather of each month.

SOILS—FERTILIZERS.

Methods of mechanical soil analysis, D. J. Hissink (*Internatl. Mitt. Bodenk., 11 (1921), No. 1–2, pp. 1–11*).—A critical study on methods of preparing samples of soil for mechanical analysis is reported indicating the marked influence of preparation on the results.

The conclusion is drawn that mechanical methods of preparation, such as grinding, shaking, or boiling, have a pulverizing effect on individual soil particles and should not be used for sand soils. The use of N/5 cold hydrochloric acid for preparation of the soil is considered to be preferable. The so-called colloidal chemical preparation in which the soil after treatment with hydrochloric acid was treated with N/10 ammonia solution was found to dissolve out the free humus acids and to have a digesting action on the clay particles and humus colloids. There was practically no difference in the final results obtained when the preparation was begun on fresh or air-dried soils.

A bibliography is appended.

A comparison of the technic recommended by various authors for quantitative bacteriological analysis of soil, Z. N. Wyant (*Soil Sci., 11 (1921), No. 4, pp. 295–303*).—In a contribution from the Michigan Experiment Station, methods for the quantitative bacteriological analysis of soils used by others are summarized and compared, and the following points suggested as being worthy of attention should the standardization of quantitative bacteriological analytical methods be considered:

"Not less than 10 gm. of soil should be used in making the first dilution. The initial dilution should be not less than 1:10. If the soil contains considerable organic matter, it should be triturated in a mortar with a little of the diluting liquid. In all cases the weighed soil sample should be made up to the volume of the desired initial dilution by the addition of sufficient diluting liquid, e. g., for a 1:10 dilution, 10 gm. of soil should be placed in the graduated flask, cylinder, etc., and sufficient diluting liquid added to bring the volume up to 100 cc. Care should be taken in making further dilutions or in plating to transfer an aliquot of the soil itself as nearly as possible. The second dilution should contain not less than one-tenth of the amount of soil in the first dilution. Noyes and Voigt's recommendation may well be followed in making succeeding dilutions, i. e., each higher bacterial dilution should be made by taking 10 cc. of the lower bacterial dilution and 90 cc. of the diluting liquid. Numbers of microorganisms (total or otherwise) should be estimated on the basis of soil oven-dried at 100° C. to a constant weight."

The adsorptive appearances in soil. Method for determination of the exchangeable or adsorptively combined bases in soil and their importance for the soil processes, D. J. HISSINK (*Dept. Landb., Nijv. en Handel [Netherlands], Verslag. Landbouwk. Onderzoek. Rijkslandbouwproefsta., No. 24 (1920), pp. 144–248*).—A number of studies are reported which led to the conclusion that bases are present in both mineral and organic soil complexes, which, when the soil is treated with a solution of one of these bases, are very rapidly exchanged with the base of the solution. Soil contains aluminum silicates and so-called humates, the bases of which are exchangeable. On the other hand, bases are present in both clay and humus which are practically not exchangeable. A part of such bases go into solution when the soil is treated with hot, strong hydrochloric acid. Such bases are therefore characterized as acid-soluble bases. It was further found that in normal clay and humus lime is the predominating exchangeable base.

However, it is concluded that lime is not less firmly combined in soil than potash, but that there are two forms of aluminum silicate and humate, the bases of which are either exchangeable or not exchangeable with the ammonia of ammonium chlorid. The further conclusion is drawn that the exchangeable bases exist in the spaces between the solid particles or solid phase of soil and the soil solution or liquid phase and are considered to be in adsorbed condition.

The amount of unfree water in soils at different moisture contents, G. BOUYOUCOS (*Soil Sci., 11 (1921), No. 4, pp. 255–259*).—Studies conducted at the Michigan Experiment Station are reported which showed that the amount of water which soils are able to render unfree does not vary with the different moisture contents, but appears to remain constant. This is considered to be of much importance, especially in relation to the availability of moisture in soils at different moisture contents, the possible behavior of soils toward fertilizers, and the physical condition of the soil.

Carbon dioxid in soil air, J. SEN (*Agr. Research Inst. Pusa, Sci. Rpts., 1919–20, pp. 41–43*).—Periodical determinations of the carbon-dioxid content of the soil air of a grassed plat, a grassed plat partly aerated by trenches, and a surface-cultivated plat showed that the percentage of carbon dioxid in the soil air was highest in the grassed plat and lowest in the cultivated plat. The variations in the carbon-dioxid content were greatest in the grassed plat and smallest in the cultivated plat.

Soil acidity and a field method for its measurement, E. T. WHERRY (*Ecology, 1 (1920), No. 3, pp. 160–173, pl. 1*).—A detailed discussion of the nature of soil acidity is given, and the conclusion is drawn that it can best be explained on the basis of the presence of hydrogen ion. Soil colloids are discussed in this connection, and it is stated that the more colloidal material a soil contains the greater will be the acidifying effect of adding a neutral salt.

The author approves of the Veitch method for determining the lime requirement of the soil and is of the opinion that the quantity of acid present in a soil is far less significant than the hydrogen-ion concentration or specific acidity when effect upon the growth of plants is under consideration. In this connection a field method for determining specific soil acidity by comparing indicator colors is described.

The cause of the acidity of soils made acid by exchange of ions, H. Kappen (*Landw. Vers. Sta., 89 (1916), No. 1, pp. 39–80*).—Studies of different mineral soils under a covering of raw humus showed that they possessed all the characteristics of acidity resulting from an exchange of ions. Therefore the exchange acidity of such soils is attributed to the action of the acid humus solution filtering down from the raw humus covering. The condition of exchange acidity was produced in neutral mineral soils by treatment with raw humus solution. The decomposition of neutral salts by raw humus was similar to its action on mineral soils; the aluminum or iron ions of the raw humus were exchanged for the metal ions of the neutral salt solution.

It was shown that many of the plants making up the raw humus were capable of causing an exchange of trivalent ions in their fresh state, and that humification of these plants does not cause this ability. The exchange acidity of raw humus produced no evident increase in the true acidity of humus solutions.

Hydrogen-ion concentration in extracts of moor soils and of plants forming moors and raw humus, H. Kappen and M. Zapfe (*Landw. Vers. Sta., 90 (1917), No. 5–6, pp. 321–374*).—In continuation of the work noted above, studies were conducted of the conditions of acidity in a series of samples of upland moor soils taken from cultivated and uncultivated and fertilized and unfertilized fields. Studies were also made of fresh undecomposed sphagnum moss and of plants from which the greater part of so-called raw humus is formed.

Digestion and seepage experiments were conducted, the former with water, normal potassium chlorid solution, and a 10 per cent solution of calcium acetate and the latter with water and potassium chlorid solution. It was found that in contrast to the digestion experiments, the seepage experiments produced solutions which possessed an important so-called titration acidity and also considerable true acidity. The water extract of the cultivated moor soil was characterized by a very low hydrogen-ion concentration in contrast to the uncultivated moor soils, indicating the influence of cultivation and liming in reducing acidity. The strong degree of disassociation of acids in the water extract of the uncultivated soils is thought to indicate the presence of strong acids such as sulphuric acid, and there was no indication of the presence of so-called humus acids.

The seepage experiments with potassium chlorid increased the true acidity and the acidity of titration in all soils. The cultivated soils again showed the lowest hydrogen-ion concentration. It is concluded that the aluminum chlorid produced in solution by exchange of ions after treatment with potassium chlorid solution is not the sole cause of the acidity of the solution. Quantitative determination of the sesquioxids in the solution showed that generally only a fraction of the aluminum estimated by titration could be precipitated from the solution. There was no equilibrium between the alkali used and the aluminum chlorid present in solution. This is explained on the basis of the absorption of part of the aluminum by the moor soil materials. In spite of the evident errors, the so-callled neutral salt decomposition is considered to be due to exchange of ions. When moor soil which had been treated with potassium chlorid solution was washed out with water a dark brown humus solution of neutral reaction was produced, and the residue gave an acid reaction with litmus paper and calcium acetate.

In the studies of plant materials, it was found that the hydrogen-ion concentration of the water extract of most of the plants studied was such as to exceed the change point indicated by litmus. The results indicate the presence of acids in plants, and that plant matter does exercise a true acid action. The observed increase in titration acidity resulting from the action on many plants of neutral salts, such as potassium chlorid, was not accompanied by a corresponding increase in hydrogen-ion concentration. The appearance of iron and aluminum in the solution after treatment of the fresh plant with potassium chlorid solution is considered to be the result of an exchange of ions.

Investigation of soil and peat residue samples from polders and lakes in connection with plans for drainage. The chemical composition of flat moor soils, D. J. HISSINK (*Dept. Landb., Nijv. en Handel [Netherlands], Verslag. Landbouwk. Onderzoek. Rijkslandbouwproefsta., No. 24 (1920), pp. 13–143, figs. 3*).—A report is presented of studies of the physical and chemical properties of the soils of polder and lake beds in swamp areas in the neighborhood of Utrecht in Holland, which it is proposed to reclaim by drainage.

These so-called "Baggererde" and "Legakkerböden were compared with moor soils of known composition and productivities. It was found that they are sufficiently supplied with plant nutrients with the exception of potash and possibly of phosphoric acid, and that the organic matter in the Baggererde or peaty residue over diluvial sand is in a sufficiently advanced stage of decomposition and humification.

It was also found that the injurious sulphur compounds present in these soils are in such form and amount as to be rendered harmless by the basic content of the drained soil without producing an acid condition due to base exhaustion. Furthermore, there is a sufficient covering of peat residues that, when mixed by cultivation with underlying sand, a humus sand soil results which compares favorably with other known humus soils in agricultural possibilities.

Profile structure of marsh soils, K. VON SEE (*Internatl. Mitt. Bodenk., 10 (1920), No. 5–6, pp. 169–185*).—Studies of a series of profiles of north German marsh soils are described, showing how the general characteristics of moor soils may be exposed and studied by this method.

Soil survey of Early County, Ga., D. D. LONG and E. C. HALL (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1918, pp. 43, fig. 1, map 1*).—This survey, made in cooperation with the Georgia State College of Agriculture, deals with the soils of an area of 313,600 acres in southwestern Georgia, which lies in that division of the Coastal Plain province known as the Dougherty Plain. The topography is undulating, with many lime sinks scattered over the surface. Drainage is generally well established, being for the most part subterranean. The soils are derived chiefly from unconsolidated marine sediments. Including swamp, 23 soil types of 14 series are mapped, of which the Norfolk sandy loam covers 30.9 per cent of the area.

Soil survey of Floyd County, Ga., D. D. LONG (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1917, pp. 72, fig. 1, map 1*).—This survey, made in cooperation with the Georgia State College of Agriculture, deals with the soils of an area of 321,280 acres in northwestern Georgia, which lies in the Appalachian Valley physiographic province. All of the area except the flatwoods section is said to be well drained. The topography includes rolling table lands, high rolling ridges, high mountain plateaus, extensive river terraces, and low alluvial areas.

The soils are widely diverse in character and are of residual, sedimentary, colluvial, and alluvial origin. Including rough stony land, 37 soil types of 19 series are mapped, of which the Clarksville gravelly loam and Colbert silt loam cover 17.6 and 9.7 per cent of the area, respectively.

Soils of the Detroit area, M. M. MCCOOL and G. M. GRANTHAM (*Michigan Sta. Spec. Bul. 104 (1920), pp. 31, pl. 1, figs. 14*).—This survey deals with the soils of an area of 987,520 acres in extreme southwestern Michigan, which includes Monroe County and parts of Wayne, Washtenaw, and Lenawee counties. The surface features are classed as sand drift, level to undulating lands, old deltas, gravelly ridges, and river flood plains. It is stated that the most important feature limiting maximum crop production in the greater part of the area is lack of drainage.

The soils of the area are mainly of glacial origin. The soil types mapped are clay loams, silt loam, fine sandy loam, brown sand, sandy loam, and sandy loam on gravelly subsoil. The brown sands are the most widely distributed of the soils and cover approximately 40 per cent of the area. The silt loam covers 30 per cent of the area and the sandy loam 15 per cent.

Soil survey of Pike County, Miss., A. T. SWEET ET AL. (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1918, pp. 32, pls. 5, fig. 1, map 1*).—This survey, made in cooperation with the State of Mississippi, deals with the soils of an area of 260,480 acres in southwestern Mississippi, the topography of which ranges from undulating to rolling, with some rough areas bordering the valleys of the larger streams. The area lies within the Coastal Plain province. Drainage is said to be in general well established. The upland soils of the area are of loessial and Coastal Plain origin. The first bottom and terrace soils are derived from the same materials reworked and redeposited. Seventeen soil types of 9 series are mapped, of which the Ruston fine sandy loam covers 57.1 per cent of the area.

Soil survey of Hoke County, N. C., E. S. VANATTA ET AL (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1918, pp. 32, fig. 1, map 1*).—This survey, made in cooperation with the North Carolina Department of Agriculture, deals with the soils of an area of 266,880 acres in southern North Carolina, which lies near the western edge of the Coastal Plain province. The area lies in two distinct physiographic regions, known as the sand hills and the flat woods. The sand-hill region is a high rolling country, dissected by numerous drainage courses. The flat-woods section is gently undulating, with many level depressed areas, and drainage is in places deficient.

The soils of the sand-hill section consist chiefly of medium to coarse sand, more or less modified by weather, drainage, erosion, and other soil-forming agencies. They are said to be thoroughly drained. Including swamp, 10 soil types of 7 series are mapped, of which the Norfolk sand, the Hoffman sandy loam, and the Norfolk sandy loam cover 35.6, 24.1, and 20 per cent of the area, respectively.

Soil survey of Orange County, N. C., E. S. VANATTA ET AL. (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1918, pp. 48, fig. 1, map 1*).—This survey, made in cooperation with the North Carolina Department of Agriculture, deals with the soils of an area of 256,000 acres in central northern North Carolina, which lies in the Piedmont Plateau region. The topography is prevailingly rolling to hilly.

The area is thoroughly dissected by streams and there are no upland areas without drainage outlets. While there are flat areas through the uplands and the wider bottoms that are poorly drained, over the greater part of the county the surface water flows off so rapidly as to cause serious erosion.

All of the upland soils of the area are of residual origin. They are grouped into three classes, namely, light-colored sandy surface soils, heavy red soils, and gray to red silt or floury textured soils. Twenty-three soil types of 12 series are mapped, of which the Georgeville silt loam, Davidson clay loam, and Conowingo silt loam cover 29, 21.4, and 10.4 per cent of the area, respectively.

Soil survey of Vance County, N. C., S. O. PERKINS and W. A. DAVIS (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1918, pp. 31, fig. 1, map 1*).—This survey, made in cooperation with the North Carolina Department of Agriculture, deals with the soils of an area of 170,880 acres in northern North Carolina, which lies wholly within the Piedmont Plateau province. The topography ranges from nearly level to rolling, hilly, and broken. The area is said to be well drained.

All of the upland soils are of residual origin. Including meadow, 21 soil types of 10 series are mapped, of which the Appling sandy loam, the Appling coarse sandy loam, and Wilkes fine sandy loam cover 20.1, 12.5, and 11.1 per cent of the area, respectively.

Soil survey of Wilkes County, N. C., R. C. JURNEY and S. O. PERKINS (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1918, pp. 39, fig. 1, map 1*).—This survey, made in cooperation with the North Carolina Department of Agriculture, deals with the soils of an area of 470,400 acres in northwestern North Carolina, which lies in the Piedmont and Appalachian provinces and ranges in topography from an elevated plateau, dissected and eroded by numerous stream valleys, to typical mountains. The county as a whole is adequately drained, and on the steep hillsides and cleared mountain slopes the drainage is excessive.

The soils are of a residual and alluvial origin. Including rough stony land, meadow, riverwash, and rock outcropping, 26 soil types of 10 series are mapped, of which the Cecil clay loam, Cecil loam, and Porter's loam, cover 21.6, 19, and 16.7 per cent of the area, respectively.

Soil survey of Spokane County, Wash., C. VAN DUYNE ET AL. (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1917, pp. 108, pls. 3, figs. 5, map 1*).—This survey, made in cooperation with the State of Washington, deals with the soils of an area of 1,123,840 acres in extreme eastern Washington, which occupies portions of the Okanogan Highlands and the great Plain of the Columbia River. High rolling to hilly areas and hilly to mountainous areas are fairly extensive in the eastern and northeastern parts of the county. Rolling prairie occurs in the southeastern part, balsatic plain mainly in the southwestern quarter, and glacial water-laid terrace areas mainly in the northern half. With the exception of a few basin-like areas the county is said to be well drained.

On the basis of origin the soils of the area are grouped as residual soils, glacial drift soils, water-laid material, wind-borne material, recent alluvial flood plain deposits, sedimentary deposits of the glacial lake basins, soils derived from accumulation of organic matter, and miscellaneous materials. Including scab land, rough mountainous land, rough stony land, rough broken land, marble sand, muck, and peat, 44 soil types of 20 series are mapped, of which Palouse silt loam, scab land, and Moscow loam cover 16.9, 12.6, and 8.6 per cent of the area, respectively.

The agricultural soils of the Union, C. F. JURITZ (*So. African Jour. Indus., 4 (1921), No. 1, pp. 76–84*).—A summary of existing knowledge of the geology of the soils of the Cape Province, Orange Free State, Natal, and the Transvaal is given. The soils of the Cape Province vary considerably, and are said to occur in more or less concentric bands with the gray and reddish loams forming the center and covering the largest area. The coastal belt in the southwest comprises gravelly clays of a drab color, while along the south coast the soils contain more humus and are frequently acid. The soils of Orange Free State and Natal are said to be more or less allied to those of the Cape Province, but the Transvaal soils are largely of very different geological origin. These soils appear to be sufficiently well provided with potash but deficient in phosphoric acid, nitrogen, lime, and humus.

The soils of Natal and the Transvaal.—I, The composition of Natal soils. II, The soils of the Transvaal, C. O. Williams and B. de C. Marchand (*So. African Jour. Indus., 4 (1921), No. 2, pp. 177–187*).—Supplementing the above report, mechanical and chemical analyses of representative samples of Natal and Transvaal soils are presented and discussed.

In general, Natal soils are characterized by the almost complete absence of calcium carbonate, this giving rise to an acid reaction and a low content of available phosphates. Most of these soils are said to contain satisfactory amounts of potash.

The bulk of the soil of the Transvaal is sedentary alluvial soil, covering small areas. The chemical analyses show that less nitrogen appears to suffice than is considered adequate in European soils, and that nitrification is rapid in almost all types of Transvaal soil. These soils are in general deficient in lime, phosphoric acid, and organic matter in spite of their good nitrifying powers. Soils containing high percentages of iron oxid are common. The soils of the region are classified as heavy, medium to light loam, sandy, and alluvial soils.

Chemical investigation of some clay soils of Surinam, J. E. van Amstel (*Dept. Landb. Suriname Bul. 41 (1921), pp. [1]+33*).—Studies of the composition and properties of representative clay soils of Surinam in Dutch Guiana are reported and discussed, together with results of chemical analyses.

These clay soils were found to be rich in colloidal silicates and to be heavy and plastic. They have a high water capacity, a low permeability, and a capillarity somewhat greater than the average. They are poorly aerated and have a high specific heat and high adsorptive powers, resulting in a considerable content of plant nutrients. Drainage, liming, cultivation, and the incorporation of organic matter were found to be the more important steps for improvement of these soils. They were rich in both potash and phosphoric acid, but deficient in available potash and phosphoric acid. The total nitrogen content was somewhat higher than the average, but the soils were found to respond to nitrogen fertilization.

The chemical and biological aspect of bhata soil of Chandkhuri Experimental Farm, Central Provinces, A. R. Padmanabha Aiyer and D. V. Bal (*Agr. Jour. India, 15 (1920), No. 6, pp. 644–649, pls. 5*).—Physical, chemical, and biological studies of the lateritic bhata soils in the Central Provinces are reported. These soils were found to contain a very low proportion of fine material and to be deficient in phosphoric acid and lime.

Experiments with leguminous crops showed that bhata soils respond to manuring with phosphoric acid and organic matter. The ammonifying power was quite good and the nitrifying power average. Nitrogen fixation appeared to be weak. The poor growth of leguminous crops in the newly cultivated soil appeared to be due to lack of phosphoric acid and insufficient nodule formation. The latter difficulty was removed to a great extent by continuous cropping. These soils are porous and are well aerated and drained.

The partial sterilization of soils, E. J. Russell (*Jour. Roy. Hort. Soc., 45 (1920), No. 2–3, pp. 237–246, pls. 4*).—A review is given of the work and methods of procedure at the Rothamsted Experimental Station on the partial sterilization of soils. It has been found that, while the use of heat in partial sterilization is perhaps more effective, chemical methods are much more convenient and potentially much cheaper.

The different studies have shown that in order to use chemical substances for the control of the soil population it is necessary to know exactly what organisms are to be dealt with, and to carry out direct experiments with those organisms to ascertain the effects of the antiseptics on them. The general action of certain chemicals is discussed. It has been found that the question of disappearance of the chemical from the soil is of very great importance. Phenol, cresol, and the chlorcresols decompose quickly and become innocuous, but the nitro compounds do not. From the chemical point of view interesting possibilities are presented by these and certain other compounds which, having acted in the first instance as partial sterilizing agents, may decompose and give rise to valuable plant nutrients. Calcium sulphate, sodium cyanid, and pyridin are given as examples of such compounds.

Experiments with Dr. Kuhn's U-cultures, C. BARTHEL (*K. Landtbr. Akad. Handl. och Tidskr., 58 (1919), No. 2, pp. 85–95*).—Qualitative bacteriological analyses of samples of so-called universal cultures, developed by Kuhn, for promoting nitrogen fixation and nitrification in soils showed that the cultures contain both symbiotic and nonsymbiotic nitrogen-fixing and nitrifying organisms commonly occurring in soils.

When used in the treatment of seed of oats, cabbage, and potatoes for inoculation of the soil, no increase in crops resulted. Crop yields were apparently not influenced, and the cultures appeared to be inactive.

Soil renovation by the planting of legumes, E. E. BARKER (*Porto Rico Dept. Agr. and Labor Sta. Circ. 31 (1920), Spanish ed., pp. 3–16*).—Popular information on the use of legumes as green manure in the improvement of Porto Rico soils is given.

The procedure of yield in agriculture by increasing outlay.—The theory of the soil law, E. LANG (*Landw. Jahrb., 55 (1920), No. 3, pp. 337–403, figs. 7*).—This discussion takes in features of the laws of minimum, of physiological relations, and of decreasing returns, with particular reference to soils and their productiveness, and presents experimental data from different sources, leading to the conclusion that the law of decreasing soil yields can be expressed mathematically as a physiological law. On the other hand, the procedure of yield does not follow a simple scheme, but is always changing either through variable conditions of growth or by a temporary lapse in the growth of plants.

The effect of continuous cropping upon the major soil nutrients, G. R. STEWART (*Soil Sci., 11 (1921), No. 4, pp. 321–323*).—Studies conducted for six years at the California Experiment Station of the changes that occur in soil nutrients as the result of the growth of successive crops of cereals on six silty clay loam and seven fine sandy loam soils, previously described (E. S. R., 38, p. 813), are reported.

The soils were collected in 2-ton samples, each sample being divided between duplicate containers holding approximately 1,800 lbs. For the first season all containers were planted to barley, but in the succeeding years one container of each soil was cropped to barley while the other was left unplanted. During this time the soil was removed from the leaching effect of rainfall or excessive irrigation.

It was found that under continuous cropping these soils notably decreased in productivity. The average decrease in total crop amounted to 34.9 per cent.

There was no apparent reduction in the phosphate content of continuously cropped soils. However, a comparison of the results of five years showed that in five of the sandy loams there was a reduction of 30 per cent or more in the content of soluble phosphates, while only two of the silty clay loams had begun to show a decrease in this nutrient. There is said to be no indication so far that the lowering of the phosphate content accounts for the first decrease in the crop yield, for most of the soils whose soluble phosphates have been reduced are at the present time producing the best crops both of grain and of straw.

Determinations made before the soils were planted showed that the fine sandy loams contained from 0.05 to 0.09 per cent, and the silty clay loams from 0.13 to 0.18 per cent, of total nitrogen. There was a continual loss of this nutrient. At the close of the season of 1919 all of the soils, both planted and fallow, showed a reduction of from 14 to 38 per cent of their original total nitrogen content.

Soil reaction and choice of fertilizers, R. GANS (*Internatl. Mitt. Bodenk., 10 (1920), No. 5–6, pp. 186–196*).—The author discusses the chemical features of fertilizer selection on the basis of soil reaction. It is pointed out that the acidity of inorganic soil constituents is produced mainly by mixtures of hydrates of silica and alumina derived from soil weathering. The degree of acidity depends upon the intimacy of the mixture of these hydrates, the so-called molecular mixtures being the most strongly acid, followed in order by the so-called nonmolecular mixtures and the coarse mixtures.

New investigations on the agricultural value of forest litter, L. TSCHERMAK (*Centbl. Gesam. Forstw., 45 (1919), No. 9–10, pp. 193–219*).—Studies on the absorptive power and fertilizing value of forest litter are reported.

The absorptive power of the litter increased rapidly with its degree of decomposition, and when strongly decomposed was found to be due not only to its humus content but also to the coarser constituents, such as needles. The fertilizing value of forest litter was found to depend upon its content of both nitrogen and valuable mineral substance. The nitrogen content of decomposed forest litter is considerably greater than that of newly fallen needles and leaves, varying in the latter case from 0.5 to 0.8 per cent, while that of the humus in humid localities averaged from 2 to 5 per cent. The fertilizing value of forest litter compared favorably with that of winter rye straw when strongly decomposed, but was only about half so valuable when in fresh condition. Beech leaves were apparently more valuable than conifer needles.

Fertilizer experiments with new nitrogenous salts in 1920, HOFFMANN (*Mitt. Deut. Landw. Gesell., 36 (1921), No. 3, pp. 26–36*).—Data on 33 tests of 10 different nitrogenous fertilizers with 8 crops are reported and discussed.

The fertilizers included, among others, ammonium chlorid, ammonium sulphate nitrate, potassium and sodium ammonium nitrates, gypsum ammonium nitrate, and urea superphosphate. In most cases these fertilizers produced profitable increases. Special attention is drawn to the results produced by the urea superphosphate, which showed profitable increases in wheat and beet crops on soil which did not respond to fertilization with phosphoric acid.

Action of dicyandiamid on plant growth, T. PFEIFFER and W. SIMMERMACHER (*Landw. Vers. Sta., 90 (1917), No. 5–6, pp. 415–430, fig. 1*).—Experiments with oats on loam soil and a mixture of loam and sand, using lime nitrogen containing 13.89 per cent total nitrogen and 1.48 per cent dicyandiamid nitrogen, are reported.

It was found that the largest application of dicyandiamid did not hinder the germination of oats. However, there was a considerable injury to the grain yield later, which was not so marked on the loam soil. Only a small fraction of the dicyandiamid taken up by the oats plants was utilized for the formation of albumin, and there was a useless storage of albumin in the leaves and stalks of the plant. This is considered to explain the injury to the grain.

It is concluded that the use of lime nitrogen containing considerable dicyandiamid need cause no important injury to crop growth, but that the dicyandiamid must be considered a useless ballast to the plant.

Improvement of lime nitrogen, H G. SÖDERBAUM (*Meddel. Centralanst. Försöksv. Jordbruksområdet, No. 210 (1920), pp. 11; also in K. Landtbr. Akad. Handl. och Tidskr., 59 (1920), No. 8, pp. 510–517*).—In order to avoid the bad effects of lime nitrogen as a fertilizer, it has been proposed in Sweden to convert it into urea before application to soil. In this connection cropping experiments with oats on sand soil, to determine the value of technical urea as a source of nitrogen, showed that urea was as effective in this respect as sodium nitrate and ammonium sulphate.

The retention of soluble phosphates in calcareous and noncalcareous soils, J. SEN (*Agr. Research Inst. Pusa, Sci. Rpts., 1919–20, pp. 35–39*).—Experiments are reported which showed that the phosphoric acid of superphosphate is retained mainly through absorption in noncalcareous soils and through chemical combination in calcareous soils. No chemical reaction could be demonstrated between the calcium carbonate of calcareous soils and solutions of di- and trisodium phosphates. The retention of phosphoric acid in this case obeyed the absorption laws.

Studies of the distribution of phosphoric acid of different phosphates by percolation through columns of the two types of soil showed that the distribution of superphosphate was uniform through a noncalcareous soil, but not in calcareous soil, the major portion of the phosphoric acid being held in the top layers. This is taken to indicate that the phosphoric acid retained in noncalcareous soils is in a much more available form than in the calcareous soils.

The presence of even 5 per cent of calcium carbonate in a noncalcareous soil restricted the diffusion of the phosphoric acid of superphosphate. On the other hand, the distribution of the phosphoric acid of those soluble phosphates which are without action on calcium carbonate was uniform through a column of even highly calcareous soil. It is considered probable, therefore, that such phosphates would be more efficacious than superphosphate in calcareous soils.

Lime requirement and reaction of lime materials with soil, C. J. SCHOLLENBERGER (*Soil Sci., 11 (1921), No. 4, pp. 261–276*).—Experiments conducted at the Ohio Experiment Station are reported, in which various lime materials were mixed with soil in undrained pots, watered, and kept partly outside and partly under greenhouse conditions, and determinations made of residual carbonate, lime requirement, and accumulated nitrates.

A relatively pure high-calcium limestone, calcite, and magnesite were very similar in behavior. Approximately one-half of an application equivalent to 3.1 tons per acre of these materials ground to pass a 100-mesh sieve was attacked within 4 weeks and two-thirds within 28 weeks. The natural carbonate dolomite was found to be about 50 per cent more resistant than the other materials, while precipitated calcium carbonate was much more easily attacked by the agencies of decomposition.

Caustic lime was apparently more reactive than the precipitated carbonate, although with time the differences noted became less. Carbonate formation was found to result from an application of chemically prepared magnesium oxid, and the amounts found gradually increased with time. On the other hand, the disappearance of carbonate from an equivalent application of chemically prepared magnesium carbonate was complete within a month, although traces of carbonate were afterwards formed. Of two samples of slag tested, so-called dicalcium silicate was found to react with soil as readily as precipitated calcium carbonate, but blast-furnace slag was less reactive than any other material tested.

Coarsely ground limestone had much less effect in reducing lime requirement than the finely ground. Limestone ground to pass a 100-mesh sieve was found to be utilized at nearly the same rate in an acid silt loam and an alkaline clay loam, but carbonate disappeared much more rapidly from an acid clay loam. The lime requirements by the vacuum method were comparable in the cases of the first two soils, but twice as great with the third.

The quantitative relations between bases not residual as carbonate and reductions in lime requirement were found to be reasonably close, a possible consumption of bases by nitrification being considered. The evidence obtained indicated that the interaction of soil constituents and calcium carbonate is sufficiently regular and quantitative for the indications of a lime-requirement method, based upon the reaction, to be of practical utility, provided the proper precautions are observed. The indications of the lime-requirement method employed were found to depend to a great extent upon such factors as the manner of preparation of the sample, the temperature, and the time allowed for the determination.

"No conclusive evidence has been obtained that heating is an undesirable feature of a perfect lime-requirement method, if we understand by that term a satisfactory method for the study of the relations between base absorbents and added bases in the soil. On the other hand, heat may be of great advantage in hastening a naturally slow reaction and may enable differences to be indicated with an exactness not otherwise attainable in a reasonable length of time."

Mechanism of the fertilizing action of sulphur, G. Nicolas (*Compt. Rend. Acad. Sci. [Paris], 172 (1921), No. 1, pp. 85–87; abs. in Jour. Soc. Chem. Indus., 40 (1921), No. 4, p. 124A*).—Experiments are reported which showed that sulphur exercises a favorable influence on the utilization of carbon dioxid by plants in addition to its other activities in the soil.

The nonbiological oxidation of elemental sulphur in quartz media, W. H. MacIntire, F. J. Gray, and W. M. Shaw (*Soil Sci., 11 (1921), No. 4, pp. 249–254; also in Jour. Indus. and Engin. Chem., 13 (1921), No. 4, pp. 310–313*).—A preliminary report is presented of studies conducted at the Tennessee Experiment Station on the oxidation of elemental sulphur in the presence and absence of appreciable quantities of iron, under aerobic and anaerobic conditions, with the unaltered medium, the sterilized medium, and the medium plus inoculation by soil infusion. The purest obtainable quartz was used as the medium.

It was found that elemental sulphur will oxidize upon moist contact with relatively pure quartz under both aerobic and anaerobic conditions. A distinct reducing and inhibitive effect was manifested by metallic iron under aerobic conditions, with a still greater similar tendency under anaerobic conditions. Limonite, on the contrary, exhibited a strong tendency to accelerate oxidation when used alone and when supplemented by magnesium and calcium carbonates. Also, the single additions of the several carbonates to the quartz-sulphur mixture increased the amounts of sulphates recovered under aerobic conditions.

The presence of sodium, calcium, and magnesium nitrates failed to alter the depressive tendencies of metallic iron, and the increase in salt concentrations exhibited an independent depressive action in the absence of metallic iron.

Fertilizer registrations for 1921, C. S. Cathcart (*New Jersey Stas. Bul. 350 (1921), pp. 5–35*).—This bulletin contains a list of registrations of fertilizer materials and mixed fertilizers offered for sale in New Jersey during the fiscal year ending October 31, 1921.

AGRICULTURAL BOTANY.

[Carnegie Institution of Washington, report of] department of botanical research, D. T. MacDougal et al. (*Carnegie Inst. Wash. Yearbook 18 (1919), pp. 57–102*).—Reports on different phases of work done during the year are noted below.

Character of protoplasm fundamental to growth, D. T. MacDougal.—The plant cell is characterized mainly by a predominance of pentosans. The metabolism of a predominantly proteinaceous unit includes the derivation of amino acids by breaking down albumins, while the amino compounds may be synthesized in the plant in which amination of the carbohydrates is the theoretical step in the construction of nitrogenous material. Growth in plants (including two processes which are outlined) is essentially a hydration expansion or swelling of a mass of pentosan-protein colloid or jelly. This forms a sac or inclosing layer of greater density, which takes in water and solutions by adsorption, imbibition and osmosis being controlled or affected by the hydrogen-ion concentration, salts, and amino compounds of the cell sap, and also by the composition of the medium or substratum and by other environmental conditions, as temperature.

The hydration of biocolloids simulating certain features of protoplasm, D. T. MacDougal.—Extensive experimentation with various biocolloids has shown that a mixture of carbohydrates and proteins may be made which will exhibit hydration relations similar to those of protoplasm. The reactions which are indicated are considered of primary significance in the mechanics of growth. Discussion is also given of data obtained during the swelling of dried sections as bearing upon the physical basis of cytological performances in the plant cell.

The effect of organic acids and their amino compounds on hydration and growth, D. T. MacDougal and H. A. Spoehr.—Tabular data and detailed deductions are presented as showing that equimolecular concentrations of the three organic acids considered present small divergence of effect on agar and more positive differences in agar-protein.

The solution and fixation accompanying swelling and drying of biocolloids and plant tissues, D. T. MacDougal and H. A. Spoehr.—The studies here noted relate to extractions from living cell masses, extractions or solutions of sections of biocolloids, acidity of fresh or living tissues, acidity of desiccated tissues, swelling of fresh sections, reswelling of extracted and dried tissues, swelling of dried tissues, and repetition of swelling and drying treatments. The treatments discussed, as applied to *Opuntia discata*, are described, with a statement of resulting data and conclusions.

Measurement of growth in terms of volume, D. T. MacDougal.—This is a study of the actual and relative increments in tomato fruits as ascertained by different methods of measurement during growth.

The daily course of growth in two types of fruits, D. T. MacDougal.—Tomato and walnut were taken as representative types of fruits, and the studies made thereon are reported in some detail.

Influence of soil aeration upon growth of shoots, W. A. Cannon.—In view of the possible survival value of some relations between roots and soil aeration, studies have been conducted (E. S. R., 41, pp. 132, 134) and are herein reported. The effects of oxygen deprivation on several plants are detailed.

The dendrograph [and work therewith], D. T. MacDougal.—A device for recording growth and other changes in volume of tree trunks during an entire season. Trees tested include *Fraxinus arizonica, Pinus chihuahuana, P. radiata, Quercus agrifolia,* and *Fagus grandifolia.*

The interrelation of photosynthesis and respiration, H. A. Spoehr and F. Long.—An extensive series of experiments, inaugurated to determine the rate of photosynthesis of isolated leaves in various stages of carbohydrate depletion, is summarized to the effect that leaves exhibiting high respiratory activity show correspondingly high photosynthetic activity, while leaves which are respiring at a low rate also fix carbon dioxid slowly. From experiments completed, a metabolic interpretation of the phenomenon of photosynthesis is considered most plausible, the whole process properly falling under that group of chemical changes designated as coupled reactions.

The most profitable conception of photochemical change is that which is based upon the principle of photo-electricity, and this favors the theory that loosening of electrons is prerequisite to photochemical reaction.

The manner in which the energy released by the respiratory actions is utilized by the plant remains unknown. The important point is the fact that the breaking down of food material, such as the relatively simple monosaccharids, yields energy in such a form and manner as to make possible synthetic activities.

Carbohydrate supply and respiration, H. A. Spoehr.—An extensive series of experiments planned to determine the rate of carbon-dioxid emission was carried out by the use of leaves cut from the plant and seedlings growing in various nutrient solutions, the results of which are discussed.

Nutritive value of food reserve in cotyledons, B. M. Duggar.—During the summer of 1919 a careful study was made of the effects of excising cotyledons after various time intervals up to 10 days after germination. Attempts were also made to substitute for the loss of the cotyledons by adding singly to the nutrient salt solution glycocoll, alanin, sodium asparaginate, urea, nucleic acid, and sodium nucleinate. None of these proved to be a nutrient substitute for the cotyledons.

Some factors in the salt requirements of plants, B. M. Duggar.—In work completed during July and August, 1919, special attention was directed to the determination of the most favorable proportions of the salts in a solution consisting of potassium nitrate, magnesium sulphate, calcium sulphate and soluble ferric phosphate, previous work having indicated special merit in such a combination of salts. A second group of experiments included a solution of iron, magnesium, and potassium salts in minimum quantities, with calcium supplied as monobasic calcium phosphate. Elaborate experiments are now in progress to determine the influence of various proportions of iron in the form of the soluble ferric phosphate contrasted with the insoluble ferric phosphate in solutions indicated.

Refinements in the indicator method of hydrogen-ion determination, B. M. Duggar.—The difficulties inherent in the hydrogen electrode method are said to be removable by the adaptation of certain types of colorimeters indicated. The development of such a method has been pursued, and the method is described.

Soil aeration experiments with helium, W. A. Cannon and E. E. Free.—Preliminary experiments with helium intermingled with air having proved harmless to ordinary plants, tests were made on sweet pea seedlings in tubes containing nitrogen alone and helium alone, or helium in slow motion. Root growth in the first two stopped at once, but was resumed when air was readmitted after three days, except in case of the main roots in the nitrogen tube. In the tube containing helium in slow motion, growth was little if any affected.

Stem analysis and elongation of shoots in the Monterey pine, F. Shreve.—During the summer of 1919 advantage was taken of several small cuttings that had been made for carrying out a stem analysis of the Monterey pine (*Pinus* *radiata*). The elongation of the shoots was found to commence early in the spring and continue until September. No definite correlation was found between growth in height and growth in diameter during the last 4 to 7 years in saplings 12 to 15 ft. high. The individual conditions of crown development must be taken into account in exact analysis of such correlation.

Plant habits and habitats in the more arid portions of South Australia, W. A. Cannon.—Some of the more important conclusions and results derived from a field study of the vegetation in central, northern, and southwestern South Australia in 1918 are detailed. A list is given of particular adjustments of species to environment.

Reactions of roots of species with dissimilar habitats to different amounts of carbon dioxid in the soil, W. A. Cannon.—A study was made of *Covillea tridentata* and *Krameria canescens* from southern Arizona, and of *Mesembryanthemum* sp. obtained near the Coastal Laboratory, Carmel, Calif. The results of the studies are tabulated.

In these experiments the amount of oxygen available for the roots rapidly decreased with the increase in the amount of carbon dioxid in the artificial soil atmospheres used, so that to the specific effects of carbon dioxid must be added the effects following partial deprivation of oxygen. This, especially in the case of high percentages of carbon dioxid, is an important factor.

Size and form of leaves in desert plants, W. A. Cannon.—Tabulation and discussion are given of leaf width, length, and area in case of a number of South Australian plants.

The origination of xerophytism in plants, D. T. MacDougal and H. A. Spoehr.—The conclusions reached as the result of this and previous work are to the effect that succulence results from the conversion of polysaccharids into pentosan or mucilages, and xerophytism from a conversion of the polysaccharids into the anhydrids or wall material, both transformations being induced by a depleted or lessened water supply in the cells.

Seasonal changes in water relations of desert plants, E. B. Shreve.—For a number of years experiments have been conducted on a successful desert perennial (*Encelia farinosa*) and on two equally successful desert annuals, a winter annual (*Streptanthus arizonicus*) and a summer annual (*Amaranthus palmeri*), with a view to discovering any changes that may occur in their water relations with the march of the seasons. The hypothesis is presented that the increase or decrease of some substance or substances within the tissues affects the water-attracting power of the colloidal jellies, and thus brings about a greater resistance to water loss on the one hand and a greater absorption by the roots on the other hand. This theory was verified with *Opuntia versicolor*, and Encelia is to be tested for the same phenomena.

Observations on the vegetation of a desert valley and a soil-temperature survey of the United States and Canada, both by F. Shreve, the ecology of the strand vegetation of the Pacific coast, by W. S. Cooper, and transpiration and absorption by roots of fleshy Euphorbias, by E. B. Shreve, are also reported and discussed.

The inheritance of germinal peculiarities [in] flowering plants (*Carnegie Inst. Wash. Yearbook 18* (*1919*), *pp. 137, 138*).—Flowers were produced in F_1 plants of a cross between the purple-leaved variety of the common barberry and the form extensively used for low hedges (*Berberis thunbergii*). It is thought possible that a tall barberry immune to wheat rust may eventually be produced from this cross. Other studies are briefly indicated.

Serological studies in the field of plant breeding, J. Becker (*Landw. Jahrb.*, *53* (*1919*), *pp. 245–276*).—Studies are described as testing the availability of serological diagnosis for the purpose of ascertaining the origin and testing the purity of seeds.

Ecology [of plants], F. E. Clements et al. (*Carnegie Inst. Wash. Yearbook 18 (1919), pp. 330–343*).—New methods have been devised for using plants as measures or indicators. In grassland, at least, the line between natural and artificial indications is said to completely disappear as a result of a study of grazing by cattle and by buffalo. The use of standard plants to measure habitats in terms of plant response and growth has been extended to include a climax and a seral group of stations.

In the endeavor to measure the carbohydrate production of plants in the field and to correlate this with light intensity and water use, further studies have been made by F. E. Clements and F. Long in habitats with measured light conditions. These have dealt chiefly with the photosynthetic activity of different species in the same light value and of the same species under different light intensities. The latter appears to exhibit basic correlations with the definite adaptations shown in shade ecads. Studies of standard plants as to differences in photosynthetic efficiency at various elevations suggest that plants may respond to differences in total light intensity that can not be recognized by photometric methods.

The investigation by G. V. Loftfield of the behavior and efficiency of stomata in plants has been continued, attention being centered chiefly on the relation of stomatal opening and closing to the efficient factors, and especially to wilting and recovery. The results indicate that most if not all herbaceous species possess stomata having a decisive regulatory action at the time of wilting, even though they may show little activity under less severe conditions.

In the study of the ecology of root systems, by J. E. Weaver, the investigation of the root systems of dominants and subdominants of prairies, mixed prairies, and short-grass plains has been greatly extended, the trench or pit method having been continued in use. The character and extent of the root systems were found to be correlated with water content in nearly all cases. In general, soil type affects root development chiefly through its influence on water content, at least in the region studied. Soil texture, however, has a profound effect upon root penetration, and competition proved to be a primary factor in the control of root development.

The survey of the native rubber plants of North America, by H. M. Hall and F. Long, was brought to a close. Five latex-bearing species are thought to be of commercial value.

Progress reports on other projects at the laboratory are included.

Use of dilatometer in studying soil and plant relationships, M. M. McCool and C. E. Millar (*Bot. Gaz., 70 (1920), No. 4, pp. 317–319*).—The authors repeated some experiments previously reported (E. S. R., 37, p. 116), obtaining additional information by means of the dilatometer used by Bouyoucos (E. S. R., 39, p. 18), the plants employed in the present study being rye, wheat, corn, and sweet and red clovers. These were grown on fertilized and untreated soils. The results as tabulated show data obtained at six dates indicated regarding the different lowerings of the freezing point (due to differences in solute concentration) at —1.5, —4, and —6° C. Discussion is given regarding these and other data not yet published.

The effect of two soil temperatures on the yield and water relations of healthy and diseased bean plants, W. H. Burkholder (*Ecology, 1 (1920), No. 2, pp. 113–123, fig. 1*).—Experimentation here recorded was carried out early in 1919 at the temperatures 18 and 26° C. (64.4 and 78.8° F.). Tabulations are given of the weekly transpirations and of the accumulated results of the experiments. These are discussed in connection with certain disturbing factors.

The plants at 26° showed more vigorous growth and a greater transpiration rate, as well as a greater yield. Water requirements for seed production vary with conditions. The data on water requirements in the present article give indications only as to the effects of various factors covered, are rather limited, and are not considered as final.

Physiological isolation by low temperature in Bryophyllum, C. M. CHILD and A. W. BELLAMY (*Bot. Gaz., 70 (1920), No. 4, pp. 249–267, figs. 6*).—To experimentation briefly reported (E. S. R., 42, p. 435) as carried out with *B. calycinum*, *Phaseolus multiflorus*, and *Saxifraga sarmentosa*, the authors add a more elaborate account of studies on Bryophyllum.

It appears that cooling a zone of the petiole to a temperature of 2.5 to 4° C. for a few days is a very effective means of inducing the outgrowth of the leaf (axillary) buds, the opposite and neighboring leaves usually showing also more or less development. Since the movement of fluids to the leaves is not appreciably lessened, it is thought that no blocking influence of inhibiting substances transported is here involved.

Subcortical formation and abnormal development of stomata in etiolated shoots of Opuntia blakeana, J. G. BROWN (*Bot. Gaz., 70 (1920), No. 4, pp. 295–307, pls. 4, figs. 1*).—This paper reports details of a comparative study of *O. blakeana* as regards the appearance, form, and structure of the normal and etiolated shoots, and of the latter as affected by reexposure to light.

Composition of gases in intercellular spaces of apples and potatoes, J. R. MAGNESS (*Bot. Gaz., 70 (1920), No. 4, pp. 308–316, fig. 1*).—This preliminary report describes an apparatus intended to be used to obtain from fruits, tubers, etc., samples of their contained gases free from contamination with air, with an account of the methods of sampling these gases.

Data obtained from work with apples show a marked variation in the composition of the contained gases under varying temperature conditions. The data from potatoes were complicated by the presence of a larger degree of absorption of the gases. Factors influencing the amount and the significance of the ratio are discussed.

Viscosity values of protoplasm as determined by microdissection, W. SEIFRIZ (*Bot. Gaz., 70 (1920), No. 5, pp. 360–386*).—This paper represents a systematic attempt to ascertain from a study of plant and animal material the exact degree of consistency of protoplasm from numerous types of cells and under different physiological conditions.

Swelling of agar in solutions of amino acids and related compounds, D. T. MACDOUGAL and H. A. SPOEHR (*Bot. Gaz., 70 (1920), No. 4, pp. 268–278, figs. 6*).—The results of a study of the swelling of agar in solutions of amino acids, in alkaline hydroxids, and in ammonium salts, herein tabulated with discussion, as possibly bearing upon growth and metabolism, are considered as having sufficient importance to warrant a continuation of this work.

Relation of potassium to growth in plants, T. O. SMITH and O. BUTLER (*Ann. Bot. [London], 35 (1921), No. 138, pp. 189–225; also New Hampshire Sta. Sci. Contrib. 18 (1921), pp. 189–225; abs. in Gard. Chron., 3. ser., 69 (1921), No. 1794, p. 229*).—The authors give the results of a study carried on to determine (1) the effect of the absence of potassium on the growth of plants and (2) to what extent recovery is possible when potassium is supplied after more or less prolonged growth in its absence. The experiments were carried on with wheat, corn, and buckwheat, most of them being conducted in water cultures, with a few sand cultures.

It was found that the reserve supply of potassium in seed was not sufficient to maintain normal growth except for a very short period of time. The amount of potassium contained in the seed did not in itself determine the length of time a plant grown from it could live in the absence of potassium without injury resulting. Symptoms of potassium starvation were found to appear early in the life of a plant, and were characterized by dwarfing of the axis and progressive death of the foliage, the older leaves succumbing first.

Recovery from potassium starvation was found to occur more slowly the longer the potassium was withheld from the plant. When potassium-starved plants were supplied with potassium the element became distributed promptly in accordance with the physiological needs of the plant. The relative potassium requirement per gram of dry matter in tops and roots was found to be the same in the case of wheat and corn, but in the case of buckwheat the requirement of the roots was higher than that of the tops. The amount of potassium usually utilized per gram of dry matter formed in normal plants of wheat and corn was substantially the same, but in buckwheat grown in the absence of potassium the amount utilized was considerably higher.

Flora of Swedish phanerogams, C. A. M. LINDMAN (*Svensk Fanerogamflora. Stockholm: P. A. Norstedt & Sons, 1918, pp. VIII+639, figs. 330*).—The descriptions are aided by a free use of drawings, several of which usually appear in each of the numbered figures.

New or noteworthy Porto Rican fungi, F. L. STEVENS (*Bot. Gaz., 70 (1920), No. 5, pp. 399–402, figs. 4*).—A brief descriptive discussion is given of *Anthostomella rhizomorphae*, *Zythia phaseoli*, the conidial phase of *Hyponectria phaseoli*, the new species *Linospora trichostigmae*, *Trabutia portoricensis*, *Hyponectria phaseoli*, and the new genus and species *Trabutiella cordiae*.

Studies in the metabolism of Actinomycetes, II, S. A. WAKSMAN (*Jour. Bact., 4 (1919), No. 4, pp. 307–330, pl. 1*).—In a continuation of work previously noted (E. S. R., 42, p. 434), the utilization of different mono-, di-, and polysaccharids, alcohols, and salts of organic acids as sources of energy for different Actinomycetes was studied.

The order of utilization of the different carbon compounds was found to be starch, glucose, lactose, maltose, glycerin, sucrose, cellulose, and the organic acids. The best growth was usually accompanied by the greatest reduction of the nitrates to nitrites and commonly by the greater increase of the pH value. Few Actinomycetes produced invertase, but even those that did not form this enzym utilized sucrose to some extent. The production of diastase by Actinomycetes was prominent and characteristic of the group, with few exceptions. Some Actinomycetes dissolved cellulose readily.

Further studies on the growth cycle of Azotobacter, D. H. JONES (*Jour. Bact., 5 (1920), No. 4, pp. 325–341, pls. 4*).—Regarding a continuation of work previously noted (E. S. R., 32, p. 33), the author reports on studies carried out with four varieties of Azotobacter isolated from garden soil at Guelph, Ont., in 1910. These organisms are said to have a complex life cycle, which is discussed.

A symplastic stage has been observed in cultures varying in age from a few days to several weeks. In this stage aggregations of cells coalesce, the cell walls appear to break down, and the plasma of the various cells intermingles, with the resultant production of regenerative granules varying in size from very minute bodies to considerably larger forms. On emergence from the symplasm these granules grow into young Azotobacter cells and reproduce by fission. Some involution forms appear to multiply to a very limited extent by a process of budding.

Thermophilic bacteria, D. H. BERGEY (*Jour. Bact., 4 (1919), No. 4, pp. 301–306*).—Data are given in tabular form resulting from an interrupted study of thermophilic bacteria (chiefly spore-forming) obtained from different sources.

Isolating single spores, C. D. Larue (*Bot. Gaz., 70 (1920), No. 4, pp. 319, 320, fig. 1*).—A new method of isolating single spores has been devised, which differs from other methods in common use in the substitution of a mechanical method of marking the location of the spores in the poured plates for the usual procedure of marking with ink dots under the microscope. A modification of this method has been found of great use in the selection of spores of Pestalozzia.

FIELD CROPS.

Summer fallowing experiments in the Judith Basin, W. P. Baird (*Montana Sta. Bul. 138 (1920), pp. 39, figs. 3*).—Results of rotation and cultural experiments conducted at the Judith Basin Substation in cooperation with the U. S Department of Agriculture from 1908 to 1918, inclusive, with winter and spring wheat, oats, barley, flax, and corn grown on fallow land, grown continuously on the same land by different tillage methods, and in rotations by different tillage methods and sequences, are reported. Yield data and production costs under the various cultural methods and rotations are tabulated and discussed.

Winter wheat gave higher average yields (1910–1918) after fallow than after winter wheat or a green manure crop, while in tests of shorter duration (1914–1918) wheat after fallow gave higher returns than when following corn but lower than after green manure. Although much more costly than other soil treatments, summer fallow gave a profit. In the short experiment, disked corn land returned a decided profit, while the crop on summer fallow barely paid expenses, and that following green manure was produced at a loss.

Summer fallowing did not increase spring wheat yields, which averaged higher when following corn or oats. Excepting green manuring, the results indicate that for spring wheat, summer fallowing was the least profitable method tested. Oats averaged higher in yield on fallowed land than after oats, wheat, corn, or green manure, but the profit obtained from summer fallowing was less than from other tillage methods except green manure. Barley after fallow gave a higher yield than when following barley, corn, or oats, but the culture of the crop on fallow was less profitable than by any other tillage method, barley grown on disked corn land returning over six times the profit obtained on fallow. In the longer period (1909–1918) flax averaged higher after fallow than following flax, but in the shorter tests (1915–1918) produced less after fallow than after spring wheat, oats, or corn. The profits on summer fallow were less than with other tillage methods. Yields of corn fodder from fallowed land averaged less than from land continuously cropped to corn, but were slightly higher than after spring wheat or barley. Corn fodder produced on summer fallowed land was decidedly less profitable than by other tillage methods.

Annual percentage yields of winter wheat, spring wheat, and oats (based on the average of all plats of the crops considered) following summer fallow showed a tendency to increase progressively, while with continuous cropping to the same crop the percentage yields tended to decrease from year to year. In the case of barley this difference was less marked in the earlier years than in the later years of the experiment.

Small grain crops in 3-year rotations of spring wheat, oats, and a year of fallow gave higher yields than in similar rotations where corn took the place of the fallow year, or when these crops were grown continuously on fall plowed land, but the acre profits were lower. Profits obtained from a 3-year rotation of wheat, oats, and fallow were decidedly lower than from continuous cropping in the first period, 1909 to 1913, inclusive, while the soil was new, but almost equal to those from continuous cropping in the second period, 1914 to 1918, inclusive, after the soil had been cropped for 5 years. This also held true. with a 4-year rotation of fallow, wheat, oats, and corn.

Fallowing generally proved more profitable than a green manure crop in a 4-year rotation in the succession of fallow, wheat, corn, and oats, but about equaled green manuring in other 4-year rotations in which oats followed the fallow or green manure crop and wheat followed the corn. Small grains in 4-year rotations, including fallow, wheat, corn, and oats, averaged higher than oats and spring wheat grown continuously on fall plowed land, but such rotations were less profitable than continuous cropping to either spring wheat or oats.

[Report of field crops work in Rhodesia, 1919–20], H. G. Mundy, J. A. T. Walters, and C. Mainwaring (*Rhodesia Agr. Jour. 18* (*1921*), *No. 1, pp. 33–42, pls. 2*).—Cultural, variety, and rotation trials with corn; variety tests with peanuts, beans, and flax; field trials with miscellaneous cereal, forage, and root crops; liming tests; and studies of the effects of crops on each other, conducted at the Salisbury Experiment Station, are reported for the year 1919–20.

[Report of field crops work in Uganda, 1918–19], L. Hewitt, T. D. Maitland, et al. (*Uganda Dept. Agr. Ann. Rpt., 1919, pp. 16–20, 26, 44–48*).—Results of field tests with cotton, flax, sugar cane, rice, wheat, and sweet potatoes at various experimental centers are reported for the year ended March 31, 1919, in continuation of work noted heretofore (E. S. R., 42, p. 32). Reports of the Imperial Institute on tests of samples of fibers, tobacco, oil seed, and cotton from Uganda are also included.

Genetic studies on the protein content of maize, E. M. East and D. F. Jones (*Genetics, 5* (*1920*), *No. 6, pp. 543–610, figs. 8*).—The authors analyze and discuss at length the work of the Illinois Experiment Station in breeding corn for high and low protein and oil content (E. S. R., 10, p. 844; 19, p. 940; 20, p. 531) and that continued by the authors as a cooperative project between the Connecticut State Experiment Station and Harvard University (E. S. R., 34, p. 431; 40, p. 323). Earlier work, where the chief object was to enhance the value of the crop by increasing the production of some chemical constituent, is also reviewed. Outstanding facts drawn from the data considered may be stated as follows:

The chemical composition is influenced by heterosis. The factors borne by a male gamete are practically without immediate influence on the seed they help to form. The protein content of the seeds of an F_1 hybrid, when corrected for the influence of the heterosis, is intermediate between that of the two parents with a tendency to be somewhat closer to that of the high potein parent.

While the authors do not maintain the desirability of breeding for high protein or other chemical constituents as a practical method of increasing food value or industrial utility, they suggest that it can be done in the following manner: Self-pollinate large numbers of plants artificially. Test the seeds produced by each individual as accurately as possible by the progeny-plat method. With the continuation of inbreeding if a large enough series be tested, near-homozygous plants with the ability to produce high protein seeds will be obtained. Some of the crosses between such types will have a high yield and will retain the power to produce large quantities of protein. While the percentage of protein in the vigorous hybrids will not equal that in the purified parent strains, it will be high and the protein per acre will be striking.

Regarding breeding for high protein, it is considered that "such results as are possible can be obtained most easily . . . by combining strains obtained by self-fertilization and selecting again from the recombinations obtained. Protein content is due to a large number of inherited factors, and various strains having the same percentage composition probably differ in respect to the factors inherited, so that there is a real chance for progress in their union. Since at the same time such a method increases productiveness by means of heterosis, it thus serves two purposes."

Experiments on the selection of yellow flint maize, 1916–1920, G. G. AUCHINLECK (*Mauritius Dept. Agr., Gen. Ser., Bul. 18 (1920), [English ed.], pp. 20, pls. 6*).—Information concerning corn breeding by selection is presented, botanical factors in the structure of the corn ear which influences selection are described, and details of field trials of selected strains are discussed.

The author found from extensive observations on the arrangement of flowers on the female inflorescence that the number of receptacles composing a whorl on the cob is not always the same, but that each type of ear has a whorl of a particular constant pattern. In a cross section of a carefully dissected ear, lines drawn joining the spaces between the two receptacles of the several pairs form a regular and simple rectilinear figure which may serve as the diagram of that type of ear.

A whorl can be regarded as a rectilinear figure upon each angle of which is set a pair of receptacles, and various types of ears may be classified according to the character of the figure, the diagram of ears of 12, 16, 20, and 24 rows of grain being respectively an equilateral triangle, a square, a pentagon, and a hexagon. Ears of the 10, 14, 18, and 22 row types are symmetrical in one plane only, and the diagrams for alternate whorls of the same ear are different. A 14-row ear is composed of triangular whorls alternately placed against four-sided figures, an 18-row ear of four-sided figures alternating with five-sided figures, etc. In another series of ears of 12, 16, 20, and 24 rows, all whorls of the same ear are of the same shape, but are so placed that on each whorl there are four adjacent receptacles. Such ears are symmetrical about two longitudinal planes, the plane passing through the central axis and between the central two of the four adjacent receptacles of each whorl, and the longitudinal plane at right angles to the first.

Certain points are common to all three types of ears. In no case are adjacent whorls of the same ear so arranged that the angles of their figures cover one another. The rows of grain on the ear are always double that of the sum of the angles of two adjacent whorls. No whorl ever differs from its adjacent whorl by more than one side, and four adjacent receptacles are not found more than once in the same whorl. These rules apparently hold for local types of yellow flint maize.

Variety tests with corn, 1917–1920, C. P. BLACKWELL, G. H. COLLINGS, and W. B. ROGERS (*South Carolina Sta. Bul. 207 (1921), pp. 19*).—Results of trials of corn varieties during the period 1917 to 1920, inclusive, are tabulated. Earlier work along this line has been noted (E. S. R., 36, p. 832).

Of the varieties tested throughout the period at the stations, Douthit led with an average acre yield of 37.4 bu., and was followed by Coker strains of Garrick, Marlboro, and Williamson, Belmont, and Lowman Yellow. Douthit with 59.6 bu. and Pee Dee No. 5 with 58.5 bu. led during the period at Pee Dee Substation, while Wannamaker Two-Eared was first in 1916 and Douthit first in 1919 at the Coast Substation.

Heritable variations in an apparently uniform variety of cotton, T. H. KEARNEY (*Jour. Agr. Research [U. S.], 21 (1921), No. 4, pp. 227–242, pls. 7, fig. 1*).—This contribution from the Office of Alkali and Drought Resistant Plant Investigations, U. S. Department of Agriculture, presents evidence of the occurrence of heritable variations in the Pima variety of American-Egyptian cotton. This variety, which originated with a single plant selection in 1910 and of which approximately 100,000 bales were produced in 1920, is probably the least variable of commercially grown cottons. Earlier work with this cotton has been noted (E. S. R., 40, p. 527).

The comparison of a progeny grown from seed of the parent individual of the variety with the present commercial stock exhibits significant improvement in the length and abundance of fiber, as well as in the uniformity of these characters. Indications of the occurrence of heritable variations were obtained in roguing fields of the Pima variety, the most distinct off-types besides a few very aberrant individuals with characters indicating hybridization with some other cotton variety, being either tall, vigorous individuals with exceptionally long internodes or stiff, slender, grayish plants having semierect branches and leaves, the leaves being narrower, more deeply lobed, and with more incurved and undulate margins than in typical Pima. The variations were much less numerous and of smaller magnitude than those observed in fields of the older Yuma variety. Breeding records also evidenced the occurrence of slight, heritable variations which could not be considered as outside the normal range of variation of this variety.

A much more striking variation, characterized by the complete or nearly complete absence of the dark red spot near the base of the petal, associated with an increased percentage of 4-lock bolls, was found to be heritable in a high degree. "The nature of this variation and the circumstances of its occurrence suggest the possibility that Upland cotton (*Gossypium hirsutum*) or Hindi cotton (*G. punctatum* Sch. and Thon.?) may have been involved in the remote ancestry of the Pima variety."

The finding of heritable variations in this apparently uniform variety is thought to justify the continuance of selection and line breeding and the roguing of seed increase fields.

Cotton facts, rev. by C. W. Shepperson-Bull (*New York: Shepperson Pub. Co., 1920, 45. ed., rev. and enl., pp. 162+LXXXII, pls. 3, fig. 1*).—A revised and enlarged edition of the work noted previously (E. S. R., 34, p. 691).

Report to the Board of Trade of the Empire Cotton Growing Committee [with summarized addition], H. Birchenough et al. (*[Gt. Brit.] Bd. Trade, Cotton-Growing Com. Rpt., 1920, pp. 74+8, pls. 7*).—This is the report of the British committee appointed "to investigate the best means of developing the growing of cotton within the Empire." The problems covered by the report include research, dissemination of knowledge, control of culture, and cotton marketing. Surveys of the cotton-growing areas, including studies of varieties, cultural and economic practices, and problems in the West Indies, Egypt, Sudan, Mesopotamia, Uganda, East Africa, Nyasaland, Rhodesia, the Union of South Africa, Nigeria, India, Queensland, and Oceania are presented in detail and summary form. Considerable statistical data are appended, together with maps of the world, West Indies, Egypt, Mesopotamia, South Africa, Nigeria, and India, indicating the cotton districts in the regions named.

Germination of seed of Phormium tenax (*Scot. Jour. Agr., 4 (1921), No. 1, pp. 79, 80*).—Germination tests of seed of New Zealand flax (*P. tenax*) grown in Scotland showed that the seed is slow to germinate and possibly does not retain the power of germination longer than one year. The standard method considered most applicable to a test of this seed is that used in testing the germinating capacity of the Chenopodiaceæ. The seeds are pressed lightly into damp sand and incubated at a temperature of 20° C. (68° F.) for 18 hours, alternating with a temperature of 30° for 6 hours.

[Experimental error in variety trials of rice], A. McKerral (*India Bd. Sci. Advice, Ann. Rpt., 1918–19, p. 30*).—Results of investigations favored in varietal tests the use of long narrow plats, 165 ft. by 6 ft., within one large evenly worked and flooded embanked field. The strips were carried across the field and separated from each other by a single line of a very late-ripening variety with a conspicuous erect type of leaf with reddish coloration. The probable error of the single plats was found to be 5 per cent, and by using 5 plats of each variety tested, differences of 10 per cent in yielding power could be detected.

[Rice production in the French colonies] (*Cong. Agr. Colon. [Paris], 1918, Compt. Rend. Trav., vol. 3, pp. 198–259, figs. 2*).—This series includes Production and Improvement of Rice in Indo-China, by G. Capus (pp. 198–214); Selection of Seed Rice by the Table of Certani, by C. Crevost (pp. 215–236); Rice in Madagascar, by Rollot (pp. 239–255); and Industrial Uses of Rice, by A. R. Fontaine (pp. 256–259).

Culture of sugar cane [in the French colonies] (*Cong. Agr. Colon. [Paris], 1918, Compt. Rend. Trav., vol. 3, pp. 107–191*).—A series of articles dealing with the production of sugar cane and cane sugar in the French colonies, including Culture of Sugar Cane in Martinique, by E. Bassières (pp. 107–133); The Sugar Cane Industry in Martinique, by Winter (pp. 134–140); Sugar Cane in Guadeloupe, by E. Isaac (pp. 141–147); Sugar Cane Culture in Madagascar, by A. Fauchère (148–166); Sugar Cane in Reunion, by Bertault et al. (pp. 167–173); New Cane Varieties, by Boname (pp. 174–182); The Sugar Question, by Fleuriot (pp. 183–185); and Sugar Legislation, by Chocarne (pp. 186–191).

Notes on improved methods of cane cultivation, G. Clarke, N. Husain, and S. C. Banerjee (*United Provs. Agra and Oudh, Dept. Land Rec. and Agr. [Pamphlet], 1919, pp. 23, pls. 10, figs. 2; also in Bul. Écon. Indochine, n. ser., 23 (1920), No. 144, pp. 633–652, pls. 10, figs. 2*).—Cultural experiments conducted at the Sugar Cane Research Station at Shahjahanpur are described and the trench method of cultivation outlined, together with a discussion of intensive cane culture.

Windrowing sugar cane in the Northwest Frontier Province (*India Dept. Agr. Mem., Chem. Ser., 5 (1920), No. 10, pp. 237–248, pls. 2*).—This memoir consists of two parts:

I. *The effect on the economic and agricultural situation,* by W. R. Brown (pp. 237–240).—Investigations in the Peshawar Valley showed the practice of windrowing sugar cane from 10 days to a month to be of advantage to sugar factories.

II. *The effect on the composition of sugar cane,* by W. H. Harrison and P. B. Sanyal (pp. 241–248).—Analyses of the juice of standing cane were compared with those of the juice of windrowed canes from the same field and showed that although windrowing tends to cause a deterioration in the purity of the juice, it brings about a concentration with the result that the amount of crystallizable sugar per unit weight of juice remains nearly constant. The weight of sucrose and crystallizable sugar in windrowed cane increases rapidly at first, is followed by a period during which the values remain practically constant, and then deterioration sets in. The period during which canes can be stored without deterioration appears to be determined by the incidence of heavy rain.

The concentration of sodium nitrate tolerated by tobacco plants, G. D. Buckner, A. M. Peter, and E. J. Kinney (*Soil Sci., 10 (1920), No. 6, pp. 487–491*).—Field experiments were conducted at the Kentucky Experiment Station, in which water containing amounts of sodium nitrate at the rate of 25, 50, 75, 100, 150, and 200 lbs. per acre in equal amounts of water, was applied to tobacco plants as they were set in the field to test the value of nitrate solutions in water used in transplanting.

On the day after setting, the plants receiving nitrate were more or less wilted, the degree of wilting varying directly with the amount, while those which received none were fresh and thrifty. The plants getting the smaller amounts of nitrate recovered, but those which received the largest quantity finally died.

The results of laboratory experiments involving the same solutions under conditions similar to the field led to the following conclusions: Sodium nitrate solutions in concentrations greater than 1 part to 3,750 parts of tap water cause a wilting which varies in intensity with the concentrations. Wilting more or less permanent in character is caused by concentrations of 150 parts of sodium nitrate to 3,750 parts of water and higher. Solutions containing 2 or 3 parts of sodium nitrate in 3,750 parts of water appear to give the best general development, even though there is a drooping at the outset.

When using a solution of sodium nitrate in setting tobacco plants or for plant beds, its concentration rather than the amount of nitrate per acre should be considered. The latter might be controlled, however, by regulating the amount of solution applied. The logical method for plant beds would be to make several applications at intervals.

Tobacco culture: Bright leaf or flue-cured tobacco, E. C. WESTBROOK (*Ga. Col. Agr. Bul. 199 (1920), pp. 36, figs. 13*).—A practical treatise on the production of bright leaf or flue-cured tobacco in Georgia, discussing cultural and field practices, insect enemies, diseases, curing, storage, and marketing. Brief information is given on the construction of curing barns, together with bills of materials and drawings of special construction details.

The production of bright tobacco, J. C. HART (*Va. Agr. Col. Ext. Bul. 62 (1920), pp. 31, figs. 7*).—Cultural, harvesting, curing, and storage directions considered essential to the production of bright tobacco in Virginia are outlined.

The production of tobacco in the French colonies, FALLETTI (*Cong. Agr. Colon. [Paris], 1918, Compt. Rend. Trav., vol. 3, pp. 291–310*).—The varieties, soils, and cultural methods involved in the production of tobacco in the French colonies are described briefly.

The weight of a hectoliter of wheat, M. RINGELMANN (*Jour. Agr. Prat., n. ser., 34 (1920), No. 51, pp. 492–496, figs. 4*).—The several devices used in France to determine the weight of unit volumes of grain and other bulk materials are described and illustrated and their relative efficiencies compared.

Determination of the specific weight of cereals, P. VIEILLARD (*Bul. Agr. Inst. Sci. Saigon [Cochin China], 3 (1921), No. 3, pp. 69–74, pl. 1*).—The author presents a detailed discussion of the above, and analyzes the work of Boerner (E. S. R., 36, p. 441) in standardizing methods of determining the test weight of grain.

The new Missouri seed law, J. MAYES (*Missouri State Bd. Agr. Mo. Bul., 17 (1919), No. 11, pp. 35, figs. 4*).—The text of the Missouri seed law effective January 1, 1920, regulating the sale, offering or exposing for sale of agricultural seeds, and providing for inspection and analysis is presented and discussed, together with illustrations of suitable forms for labeling the three distinct classes of seed provided in the act.

HORTICULTURE.

Pages from a garden notebook, MRS. F. KING (*New York: Charles Scribner's Sons, 1921, pp. XI+291, pls. 16, figs. 2*).—A popular discussion of gardens, plants, and related subjects.

Carbonic acid gas as a fertilizer, JESS (*Jour. Agr. Prat., n. ser., 35 (1921), No. 13, pp. 250–252*).—In greenhouse and field investigations on the effect of applications of carbon dioxid to certain vegetable crops, the yield of greenhouse-grown tomatoes was increased from 29.5 kg. for an untreated house to 81.3 kg. for the treated. The yield of greenhouse cucumbers was increased from 138 to 235 kg.

Outdoor experiments with Irish potatoes resulted in increasing the weight of the average tuber from 140 to 330 gm. In an effort to determine the amount of carbon dioxid assimilated by the plants, two equal sized greenhouses, in one of which were growing 300 well-developed tomato plants and the other empty, were supplied with 1 per cent of the gas. A determination after a certain interval showed that the carbon dioxid content of the house with plants was markedly less than that of the empty house. The author believes that the gas escaping from organic manures has a marked influence on the growth of plants, and cites the results of an experiment with celery, carrots, and beans as evidence.

Report of dusting and spraying investigations, E. N. Cory (*Md. Agr. Soc. Rpt., 5 (1920), pp. 318–327*).—A report of 1920 investigations with various dusts and sprays in Maryland orchards and gardens.

In a test of dusts for the control of the terrapin scale on peach trees, at Smithsburg, three applications of a mixture of 60 per cent sulphur and 40 per cent lime resulted in a mortality of 94.2 per cent, as compared with 22.9 per cent for the untreated trees. The value of dust applications consisting of 85 per cent sulphur and 15 per cent arsenate of lead for the control of the strawberry weevil was shown by increased yield of fruit. A mixture consisting of 85 per cent sulphur and 15 per cent calcium arsenate gave complete control of the strawberry beetle. Dusting experiments on peas, beans, and tomatoes for the control of aphids, although yielding variable results, led the author to conclude that truck-crop dusting offers great promise.

Better seeds for truck growers, D. N. Shoemaker (*Md. Agr. Soc. Rpt., 5 (1920), pp. 362–366*).—A brief account of the author's investigations of variability in the Alaska pea. The study was prompted by the discovery of two undesirable strains of peas in Maryland in 1920, one a late and irregular maturing strain and the other yielding a dark undesirable canned product.

Inheritance studies with cabbage and kohl-rabi, Herrmann (*Gartenwelt, 25 (1921), No. 15, pp. 146–148, fig. 1*).—The inheritance of head and root formation was studied in cabbage, kohl-rabi, and closely related plants. Of 10 crosses involving cabbage, cauliflower, and Brussels sprouts, only one resulted in satisfactory head formation in the F_1 generation. On the contrary, in crosses between cabbage and kohl-rabi the enlargement of the root proved to be a dominant character. Crosses between the above species and more widely separated Cruciferae, such as mustard, charlock, radish, and rape, resulted in the formation of pods but no viable seed. The author points out the ease with which the closely related species are crossed by insects and other mediums, and points out the necessity of more intelligent care in seed production.

Argentine fruit industry, C. D. Girola (*Bol. Min. Agr. [Argentina], 26 (1921), No. 1, pp. 29–59, figs. 6*).—A brief review of the fruit industry of Argentina, including statistical data relative to imports of fresh and dried fruit. Cultural and varietal notes are given on the fruits grown in Argentina.

Notes on Indo and South China species of Pyrus, Juglans, and Castanea, A. Chevalier (*Compt. Rend. Acad. Sci. [Paris], 170 (1920), No. 22, pp. 1335, 1336*).—Brief observations are given on certain wild and cultivated species of Pyrus, Juglans, Castanea, and Castanopsis. *P. pashia* and *P. granulosa,* found wild in the mountains of Indo-China, are suggested as possible root stocks. *J. duclouxiana,* cultivated in Yunnan, yields a thin shelled nut.

Pollination of tree fruits, F. DUJARDIN (*Rev. Hort.* [*Paris*], *93* (*1921*), *No. 17, pp. 300–302*).—A brief discussion of sterility and intersterility in the apple and plum. Coe Golden Drop, Coe Violet, Crimson Drop, and Jefferson plums were found to be unsatisfactory pollenizers for any other variety, whereas the Damsons and other varieties belonging to *Prunus insititia* proved of value for this purpose. The author obtained contradictory results in crossing Cox Orange with Sturner Pippin, and advises the necessity of thorough study before arriving at final conclusions.

Frost resistance in fruit varieties, O. BISSMANN (*Deut. Obstbau Ztg.*, *67* (*1921*), *No. 21, pp. 98, 99*).—Several varieties of apples, pears, plums, and cherries are classified according to blooming period and degree of resistance to frost.

The Lorette method of pruning, E. BÜNSCH (*Deut. Obstbau Ztg.*, *67* (*1921*), *No. 15, pp. 68–71, figs. 5*).—A discussion of the technic and merits of the Lorette method of summer pruning of apples and pears. The operation, consisting of the repeated cutting back of woody shoots with the resulting formation of flower buds at their base, is deemed of value by the author and is said to promote a greater and more regular production of fruit.

Ripening of pears and apples as modified by extreme temperatures, E. L. OVERHOLSER and R. H. TAYLOR (*Bot. Gaz.*, *69* (*1920*), *No. 4, pp. 273–296*).—A detailed report on storage experiments with pears and apples, the substance of which has been already noted (E. S. R., 42, p. 832).

Orcharding (*Mass. Dept. Agr., Agr. Ser. No. 2* (*1920*), *pp. 183, pls. 34, figs. 22*).—This is a revision of the fifth edition of the bulletin entitled Apple Growing, published in 1916.

Variation in seedling apples, F. C. BRADFORD (*Natl. Nurseryman*, *29* (*1921*), *No. 6, p. 152*).—A brief account of variations observed in the trunk girth of seedling apple trees of known parentage at the Missouri Experiment Station. Seedlings in which Geniton parentage was present were found to have an average circumference of 9.2 in., those without Geniton parentage, 12.7 in. All trees were growing on their own roots. Data for 7 of the 16 crosses represented in the orchard are presented in tabular form.

Northwestern apple packing houses, R. R. PAILTHORP and H. W. SAMSON (*U. S. Dept. Agr., Farmers' Bul. 1204* (*1921*), *pp. 39, figs. 26*).—A contribution from the Bureau of Markets, U. S. Department of Agriculture, relating to the details of construction, arrangement, equipment, and operation of boxed apple packing houses, based on a study of commercial methods and practices. The text is abundantly illustrated.

The Herald—new type of prune, L. R. DETJEN (*Jour. Heredity*, *11* (*1920*), *No. 6, pp. 253–258, figs. 5*).—An illustrated paper, the subject material of which has been noted from another source (E. S. R., 45, p. 139).

Fertilizer studies with the grape, H. SICARD (*Prog. Agr. et Vitic.* (*Ed. l'Est-Centre*), *42* (*1921*), *Nos. 22, pp. 522–524; 23, pp. 550–553*).—In a comparison at Grammont, Mas Rouge, Mas de la Rode, and Rochet, France, of manure *v.* chemical fertilizers for grapes, the latter gave the larger yields at Grammont, Rochet, and Mas Rouge, while at Mas de la Rode an increased yield was obtained from the use of manure. Both manure and chemicals gave appreciable gains over the check plats.

The results of experiments conducted at Grammont and Mas Rouge to determine the essential fertilizing elements for the grape and the most desirable combinations thereof, presented in tabular form, indicated that dried blood was the most valuable source of nitrogen. At Grammont the combination of nitrate and sulphate of potash proved superior to muriate of potash alone, at Mas Rouge there was no difference. At Mas Rouge acid phosphate proved the best source of phosphoric acid, while at Grammont there was no marked difference between the three forms used.

Training the grape, E. KUHLMANN (*Rev. Vitic., 54 (1921), No. 1398, pp. 271–274*).—The horizontal system of grape training is discussed, with special reference to the advantage over the usual French systems in increasing the yield, especially of the strong-growing hybrids.

Commercial grape growing, J. R. COOPER (*Arkansas Sta. Bul. 174 (1921), pp. 3–39, figs. 23*).—Practical information is given on the culture of the grape in Arkansas, including propagation, laying out the vineyard, pruning and training, control of insect and fungus pests, and handling the crop.

A new hybrid—the Katharine blueberry, F. V. COVILLE (*Jour. Heredity, 11 (1920), No. 8, frontispiece, fig. 1*).—The fruits of this new hybrid blueberry average over 0.5 in. in diameter. A record of its origin is given.

The cultivation of the coconut in Porto Rico, P. GONZÁLEZ Ríos (*Porto Rico Dept. Agr. and Labor Sta. Circ. 35 (1921), Spanish ed., pp. 20, figs. 5*).—Practical directions are given for the cultivation of the coconut palm with reference to site, selection of seed nuts, preparation of seed bed, planting, care of plantation, fertilizers, outline for a fertility test, disease and insect pests, and the preparation of fiber from the husk.

Coconut [fertilization] experiments (*Trop. Agr. [Ceylon], 56 (1921), No. 5, pp. 274–277, fig. 1*).—A summary of results with coconut fertilizers in experiments at Chilaw extending over the period 1915–1920. The trees receiving an annual application of 8 lbs. of steamed bone meal gave the highest average yield, but the gain over the nonfertilized, clean-weeded plat was very slight. The data are presented in tabular and graphical form.

Coachella Valley grapefruit, A. D. SHAMEL (*Citrus Indus., 2 (1921), No. 5, pp. 16, 17, fig. 1*).—A paper dealing with grapefruit culture in the Coachella Valley, Calif., and emphasizing the value of selected stocks.

The Satsuma orange in southern Alabama, A. D. SHAMEL (*Calif. Citrogr., 6 (1921), No 9, pp. 308, 328–331, figs. 6*).—A popular review of the development and present status of the Satsuma orange growing industry in southern Alabama, with particular reference to the utilization of scientific knowledge in propagation, control of disease and insect pests, and general orchard practices.

Economic plants of the Belgian Kongo, E. LEPLAE (*Bul. Agr. Congo Belge, 12 (1921), No. 1, pp. 87–90, 110, 111, 183–189, figs. 4*).—Brief notes are given on the behavior of citrus species, including the orange, grape fruit, and lemon, all of which are said to succeed admirably at Katanga. Notes are also included on the culture of the banana, papaya, and coffee.

The tree dahlia of Guatemala, W. POPENOE (*Jour. Heredity, 11 (1920), No. 6, pp. 264–268, figs. 3*).—A brief, illustrated account of a Guatemalan dahlia species, *Dahlia maxoni*.

Growing Easter lilies in the hardy garden, D. GRIFFITHS (*Gard. Mag. [New York], 33 (1921), No. 2, pp. 107, 108, fig. 1*).—A popular article pointing out the fact that the Easter lily may be grown in the garden as a hardy herbaceous perennial, and giving suggestions relative to propagation by bulblets and seed.

Native hawthorns for our gardens, J. DUNBAR (*Gard. Mag. [New York], 33 (1921), No. 2, pp. 102–107, figs. 5*).—This paper on the North American hawthorns points out their remarkable decorative value and discusses the 21 natural groups in relation to distribution and valuable species, giving in some instances the distinguishing characteristics of the groups and species.

The American rose annual, 1920 and 1921, edited by J. H. McFarland (*Amer. Rose Ann., 1920, pp. 188, pls. 20, figs. 7; 1921, pp. 192, pls. 17, figs. 13*).—The 1920 annual, similar to those of preceding years (E. S. R., 41, p. 242), contains papers on breeding, variety testing, and other phases of rose production in this country and abroad. The list of roses introduced in America is revised to March 17, 1920.

A paper on Rose-breeding Notes for 1919, by W. Van Fleet (pp. 23–30), records the author's rose-breeding activities for the year 1919 at Glendale, Md. Many new and little used species were successfully used as parents, notably 13 species from north and central China. Of these *Rosa gentiliana* and *R. helenae* are deemed of greatest promise. *R. moyesii*, on account of the handsome deep red color of its bloom, is considered very valuable and has been used extensively. *R. wichuraiana* is said to have given very satisfactory results when crossed with florist varieties. Many other species are discussed in relation to their own merit and that of their seedlings.

Night Growth of Roses, by A. W. Greeley (pp. 40–42), is a brief account of studies made on the growth of hybrid tea rose varieties, including Lady Pirrie, Radiance, and Killarney Queen. Measurements of cane growth showed a night growth of approximately 63 per cent for Lady Pirrie, 80 per cent for Radiance, and 54 per cent for Killarney Queen.

The National Rose Test Garden to Date, by F. L. Mulford (pp. 137–145), is a tabulated report of the behavior of rose varieties in the Arlington, Va., test garden.

The Story of the Baby Ramblers, by F. L. Mulford (pp. 57–59), and A Serious Menace to Greenhouse Roses, by C. A. Weigel (pp. 66–69), are also among the papers included.

The 1921 annual contains contributions from all over the world upon progress and activities in the culture and breeding of the rose in 1920. The official list of American roses is corrected to March 10, 1921.

Rose Breeding in 1920 at Bell Experiment Plat, by W. Van Fleet (pp. 25–31), records the author's activities in rose breeding at Glendale, Md., during 1920. "Particular attention was given in 1920 to the utilization of the lesser-known northern species of both hemispheres, such as *Rosa inodora*, *R. pulvurulenta*, *R. murielae*, *R. hibernica*, *R. micrantha*, *R. involuta*, and *R. jundzillii* of the Old World, our native *R. macounii* and *R. nutkana*, and the most northern forms of *R. nitida*, *R. pratincola*, and *R. lucida* or *R. virginiana*." The intrinsic and breeding values of *R. willmottiae*, *R. hugonis*, *R. xanthina*, *R. hispida*, *R. bella*, and *R. moyesii* are discussed.

Rose Stocks and Root Systems, by H. H. Hume (pp. 47–54), is a discussion of the merits of several different rose species as source of rootstocks. The author points out his succesful experience with the Double or Evergreen Cherokee.

Our Native Roses (pp. 34–43) and Select Roses for a Washington Garden (pp. 89–93), both by C. E. F. Gersdorff, are also among the papers included.

Tree planting in Texas towns and cities, L. Wyman (*Tex. State Forester Bul. 11 [1920], pp. [38], figs. 18*).—This descriptive circular relative to the shade trees of Texas towns and cities, gives notes on their value, regional adaptation, and peculiarities. Lists are included of the trees best adapted to the east, central, south, southwest, and panhandle sections of the State. Directions are given for the planting and care of young trees, with notes on insect and fungus pests.

Pruning, F. L. Mulford (*Amer. Forestry, 27 (1921), No. 330, pp. 390–393, figs. 5*).—A brief, popular article on the pruning of ornamental trees and plants.

FORESTRY.

Forestry in relation to land economics, W. D. STERRETT (*Jour. Forestry, 19 (1921), No. 3, pp. 224–236*).—A discussion of the importance and necessity of establishing a systematic program of land classification in the United States to determine especially land to be recommended as economically best suited for the growing of forests, public and private. The forest policies of England and this country are discussed, and a résumé of the findings of a committee on land classification, appointed at a conference of U. S. Department of Agriculture workers, is included. The author believes that forestry often has a general advantage over agriculture as a form of land utilization, and strongly urges that all public forestry agencies should enter the field of land classification and that the national forest program should concentrate largely on land classification with reference to what lands should be used for forests. A plan of work is suggested for local or county land classification.

Comments on the paper by L. C. Gray, of the Office of Farm Management and Farm Economics, are appended.

A forest policy for Florida, J. G. PETERS (*Fla. Grower, 24 (1921), No. 1, p. 6, fig. 1*).—An address delivered before the Forestry Congress, at Tallahasse, Fla., in April, 1921, in which the author points out the depletion of Florida forests and emphasizes the need of a systematic forestry policy, the principal feature of which should be fire prevention.

Forestry in the United Kingdom (*London: Govt., 1920, pp. 43*).—A statement prepared by the Forestry Commission for the British Empire Forestry Conference held in London in 1920. The subject is treated under the following headings: General description of the country; main types of forest growth and their distribution; area covered by existing forests; notes on the most important timbers; ownership of forests; relationship of the State to the forests; the forest authority; forestry activities of municipal and corporate bodies and private individuals; professional and other societies interested in forestry; education, research, and experimental work; annual increment and utilization of home-grown timber; forest industries; exports and imports of timber; and summary and outlook.

Statement prepared for the British Empire Forestry Conference, London, 1920, C. E. LANE-POOLE (*Perth, West. Australia: Min. Forests, 1920, pp. 35, pls. 20*).—A statement of the forest resources and activities of Western Australia prepared in a similar manner to the above, but amplified by the addition of maps, chiefly illustrating the distribution of the important species.

Annual reports of the Crown Land Department of the Province of New Brunswick for the years ended October 31, 1919, and October 31, 1920 (*New Brunswick Crown Land Dept. Ann. Rpt., 59 (1919), pp. 210, pls. 29; 60 (1920), pp. 101, pls. 3*).—The report for the year 1919 contains, in addition to the customary administrative and fiscal statements, subreports relating to mining, water power, forest fires, forest survey, the spruce budworm, experimental cuttings, game protection, and the annual growth of various trees. In the fourth annual statement of the progress of the Forest Survey of the Crown Lands, by G. H. Prince (pp. 116–124), it is stated that approximately 530,000 acres were examined during the year, bringing the total to 29 per cent.

The report for 1920 is much the same as the above. In the fifth annual progress statement of the Forest Survey of the Crown Lands, by Prince (pp. 78–81), it is stated that 926,442 acres were surveyed during the year, completing 42 per cent of the total Crown-land area.

The burning of dead and down trees as a practical protection measure, R. B. WEAVER (*Jour. Forestry, 19 (1921), No. 5, pp. 506–511*).—A brief account is given of an experiment carried out in late October and early November, 1920, in the Modoc National Forest, California, to determine the cost and efficiency of the burning method of destroying dead standing and fallen trees. The burning was done in a pure stand of western yellow pine, averaging about 15,000 ft. per acre.

"An area of 2,000 acres was covered in 11 days' work. During this period 4,600 standing and down trees were set on fire. Of this number 1,695 were standing and 2,905 were down trees. Not less than 80 per cent of the standing trees burned to such an extent that they fell a few hours after being fired. A very considerable per cent burned up entirely after falling. A greater part of the down trees were consumed, so that a much cleaner area existed, with no damage having been done to the living trees or reproduction." The work, performed at an average cost of 14 cts. per acre, was, according to the author, much less expensive than any other method and equally as satisfactory in results.

Yellow birch and its relation to the Adirondack Forest, E. F. MCCARTHY and H. C. BELYEA (*N. Y. State Col. Forestry, Syracuse Univ., Tech. Pub. 12 (1920), pp. 50, pls. 2, figs. 6*).—The types and conditions of yellow birch (*Betula lutea*) found in the Adirondacks are discussed, and comparative data are presented to show the silvicultural relation of birch to other native species. Yellow birch is said to have an advantage over the beech, sugar maple, and red maple in the seizure of devastated areas, in that its seeds are more motile and more numerous, and its seedlings root easier and grow more rapidly. Among the topics taken up are the influence of logging and of burning on the forest, planting on cut-over lands, growth of hardwood saplings, and growth and yield of yellow birch in pole and virgin stand.

A research on the eucalypts, especially in regard to their essential oils, R. T. BAKER and H. G. SMITH (*N. S. Wales, Technol. Mus., Tech. Ed. Ser., No. 24 (1920), pp. XV+471, pls. 75, figs. 221*).—A second, enlarged, and verified edition, the original of which has been previously noted (E. S. R., 14, p. 1076). The geographical area covered embraces New South Wales, Victoria, Tasmania, South Australia, and Western Australia, a considerable extension beyond that of the first edition.

Palm trees of the lower and middle Kongo, R. P. H. VANDERYST (*Rev. Gén. Agron., n. ser., 11 (1921), No. 2, pp. 33–46*).—A descriptive article on the palms of the Kongo, in which the author, dividing the trees in five groups, describes the more important species and gives notes on their distribution and economic value.

Contribution upon the life history of Populus tremula, D. BURGER (*Beiträge zur Lebensgeschichte der Populus tremula L. Thesis, Eidg. Tech. Hochsch., Zurich, 1920, pp. 79, pl. 1, figs. 32*).—A technical study of the European aspen (*P. tremula*), in which the morphology and physiology of the buds, bud scales, petioles, and leaves are discussed in detail. Attention is drawn to the variation in shape of leaves from different parts of a tree and to the cause of trembling of the leaves.

Regional development of pulpwood resources of the Tongass National Forest, Alaska, C. G. SMITH (*U. S. Dept. Agr. Bul. 950 (1921), pp. 40, pls. 4, figs. 2*).—This contribution from the Forest Service presents information on the timber and other resources of the Tongass National Forest in Alaska. The statement is prepared "to indicate the capital and organization necessary for the development of Alaskan pulp and paper mills, to show what data on the timber resources of that region have been and are being collected by the Forest Service, and to outline the conditions of purchase of timber on the National Forests."

Western hemlock (*Tsuga heterophylla*) is said to constitute 60 per cent and Sitka spruce (*Picea sitchensis*) about 20 per cent of the merchantable timber of this forest. Data are given on climate and geographic features of the region, the amount and quality of the timber, labor, water supply and power, procedure in Government timber sales, etc. A sample copy of the agreement to be drawn between the Forest Service and purchasers of timber is included.

Indian timbers, R. S. TROUP (*Indian Forester, 47 (1921), No. 5, pp. 196–209*).—A paper read before the Indian Section of the Royal Society of Arts, January, 1921, presenting descriptive notes and observations on some of the more important timbers of India, especially those of export value. Teak, sal, and deodar are deemed the three most valuable species. Attention is drawn to the part Indian timbers played in the war.

DISEASES OF PLANTS.

[Plant pests and diseases, Philippine Islands], A. HERNANDEZ (*Philippine Agr. Rev., 12 (1919), No. 2, pp. 85–93, pls. 5, fig. 1*).—Besides including an account of animal pests, this report deals with the investigation of diseases of the coconut palm, in particular the rôle of insects in the spread of bud rot (*Bacillus coli*); a disease, *Ustilago virens*, causing swelling and orange color in rice grains; a hitherto unknown rice disease, *Phyllosticta miuai*, reported at the Lamao Experiment Station, and what appears to be the Fiji disease (*Plasmodiophora* sp.) of sugar cane.

Some observations on Erysiphe polygoni, G. O. SEARLE (*Brit. Mycol. Soc. Trans., 6 (1919), pt. 3, pp. 274–293*).—In field trials carried out during 1913–14 at the Southeastern Agricultural College, Wye, and in part previously noted (E. S. R., 34, p. 52), the author found no variety immune to *E. polygoni* out of 27 varieties of swedes, turnips, and rape. "In inoculation experiments with cultivated varieties of *Brassica campestris* and *B. oleracea*, the form of *E. polygoni* infecting these varieties was found to be a biologic form, with this additional distinction that inoculations from *B. campestris* to *B. oleracea* invariably gave subinfections as the result. Biologic forms on *Polygonum aviculare, Trifolium pratense*, and *Pisum sativum* were indicated. Subinfections on varieties of *B. oleracea* were observed in the field and found to exist over the winter and in some cases grow into full infections. Inoculations were undertaken in the laboratory and were successful both on uninjured leaves and on the internal tissues of stems; these latter were carried as far as the fourth generation. Inoculations with conidia from subinfections were carried out and the conidia shown to be viable. It is suggested that the most probable method of overwintering of the biologic form of *E. polygoni* on the cultivated Brassicae is by means of subinfections on varieties of *B. oleracea*, aided by persistent mycelium on varieties of *B. campestris*."

Bacterial blight of beans, C. W. RAPP (*Oklahoma Sta. Bul. 131 (1920), pp. 39, figs. 17*).—The results are given of a technical study of the bacterial blight of beans due to *Bacterium phaseoli*, in which the author describes the field characteristics of the disease under Oklahoma conditions, presents evidence regarding the means by which the organism passes the winter and the modes of infection and dissemination, and gives practical means for the control of the disease.

Considerable variation was observed in the susceptibility of different varieties of beans.

In the experiments for the control of bacterial blight various methods were tested. Bacteria were found to survive the winter in, or on, the seed, in the soil, and on bean straw. Spraying proved of no value as a control measure, and seed treatment by chemicals, hot water, and dry heat was found impracticable on account of the effect the treatment had on the germination of the seed. Pod selection was found to have some advantage, and the planting of blight-resistant strains of beans is recommended. The most practical method of control appears to be the use of old seed, no disease appearing in any of the plants where two or three-year-old seed was planted. In germination tests of a considerable number of varieties of beans it was found that the percentage of germination did not diminish materially until seed was more than three years old.

Bacterial wilt of castor bean (Ricinus communis), E. F. SMITH and G. H. GODFREY (*Jour. Agr. Research* [*U. S.*], *21* (*1921*), *No. 4*, *pp. 255–262*, *pls. 13*, *fig. 1*).—In a contribution from the Bureau of Plant Industry, U. S. Department of Agriculture, the authors describe a bacterial wilt of castor beans found to be due to *Bacterium solanacearum*. The disease was first called to their attention in May, 1918, and a survey made at a later date showed the occurrence of the disease at or near a number of towns in Florida, as well as in Georgia and Alabama.

The disease is characterized by a rapid wilting, and if the plants are small they may be destroyed. If the infection takes place late in the season it may not result in the permanent wilting or death of the plants, but usually in such cases marked dwarfing of the plants occurs.

The organism causing the wilt was isolated from castor beans, and successful inoculations were made on tomato plants, jimson weeds, and the common nasturtium. Subsequently young cotton plants were infected, as were vanilla, grown in hothouses, and young sunflowers. In 1920, the dwarfing of castor bean plants was obtained with *B. solanacearum* isolated from wilted North Carolina tobacco. Fuchsias were also shown to be susceptible.

Stewart's disease of corn, F. V. RAND and L. C. CASH (*Jour. Agr. Research* [*U. S.*], *21* (*1921*), *No. 4*, *pp. 263*, *264*).—As a result of an investigation carried on by the Bureau of Plant Industry, U. S. Department of Agriculture, the authors report a disease of corn which is due to *Aplanobacter stewarti* as occurring in Georgia, South Carolina, Tennessee, Virginia, Kentucky, Missouri, Iowa, Illinois, Indiana, Ohio, Pennsylvania, District of Columbia, Maryland, Delaware, New Jersey, southern New York, and Connecticut.

It is said that under field conditions the number of diseased plants is usually under 20 per cent, but among early varieties of sweet corn sometimes 100 per cent infection has been found. Tests were made of seed of 53 varieties of sweet corn purchased in the open market and planted in three seasons. As a result of these plantings it was found that the later varieties consistently gave a low percentage of the disease, while the earliest varieties under the same conditions showed a serious loss from wilt. In general, wilt prevalence among mid-season varieties was between these two extremes.

An investigation was carried on to determine whether infection could come from the soil or proximity to diseased stalks, but thus far no evidence has been secured to indicate these as sources from which the organism can be transferred. Infection of the young corn plant from the seed was found to be largely dependent upon the growth condition of the seedling during the first week or two after planting, as influenced by soil moisture, soil texture and fertility, and temperature. It appears that anything which retards the germination and early development of the seedling lessens the chances of infection from the seed.

Control methods have been undertaken but they are still in the experimental stage. However, preliminary results are said to indicate that northern-grown seed is less liable to carry infection than that grown farther south, and that infected seed may be rendered safe for planting by a dry-heat pasteurization at 60 to 70° C. for one hour.

Arkansas cotton diseases, J. A. Elliott (*Arkansas Sta. Bul. 178 (1921), pp. 3–26, figs. 26*).—Popular descriptions are given of a number of the more common diseases of cotton, the descriptions being designed to enable the reader to distinguish between the various diseases and tell their causes. So far as known, methods of control are suggested.

In connection with the discussion of the angular leaf spot due to *Bacterium malvacearum*, the author reports experiments in delinting the cotton seed with sulphuric acid before planting and in the use of old seed. Where the seed was delinted no angular leaf spot, anthracnose, or Diplodia boll rot appeared upon the plant, except where plants had been artificially infected or the disease had gained entrance from untreated fields. In the case of the testing of old seed no disease appeared on any of the plats except where one- or two-year-old untreated seed was used.

Yellow-leaf disease in Phormium tenax (*New Zeal. Jour. Agr., 19 (1919), No. 2, pp. 89–93*).—Extracts, with discussion, from reports made by L. Cockayne, detail the nature and progress of flax yellow-leaf disease, which has in recent years caused grave concern in regard to the flax-milling industry in New Zealand.

The author now considers yellow leaf an infectious disease, probably due to attack by fungi or bacteria. The view that yellow leaf is favored by stagnant water is upheld. The periodical examination of marked plants has shown, among other facts, that a great improvement occurs in autumn and winter, followed by progressive deterioration in spring and summer; that plants or portions thereof may remain healthy in close proximity to diseased plants; that a portion of a diseased plant which by extension of the rootstock reaches level ground generally becomes healthy and makes good flax; that diseased plants frequently recover completely; that great fluctuations may occur during the year; that very few plants die outright; and that some plants appear to be immune to the disease.

[Potato canker], E. Schaffnit and G. Voss (*Ztschr. Pflanzenkrank., 27 (1917), No. 7–8, pp. 339–346*).—Potato canker studies during 1916 dealt with soil disinfection, varietal resistance, and viability of the spores of the potato canker organism (*Chrysophlyctis endobiotica*). Disinfection and varietal resistance data are given in tabular form. Soil was found to retain infection in virulent form after eight years.

Origin of potato rust, J. C. Arthur (*Science, n. ser., 53 (1921), No. 1367, pp. 228, 229*).—In a previous publication (E. S. R., 43, p. 346), the author called attention to a potato rust in Central and South America. Since that time the fungus has been reported in one field in Florida, but as a precaution all vestige of it was destroyed. The author reports that during 1918 this potato rust (*Puccinia pittieriana*) was very abundant and harmful on the experiment station grounds at Ambato, Ecuador, not only on potatoes but more so on tomatoes, showing a decided preference for the North American varieties of tomatoes. Mention is made of two rusts, one from Colombia on *Saracha edulis*, a close relative of Solanum, and the other on *Solanum triquetrum*. These differ in some particulars, so that it is not possible to state whether they are distinct species or not. The occurrence of these three forms in Central and South America is considered evidence that the potato rust has originated somewhere between Ecuador and Costa Rica on hosts native to those localities.

Progress in 1918 in controlling potato diseases, G. R. BISBY (*Minn. Hort., 47 (1919), No. 12, pp. 462–465, figs. 2*).—Treatment of potato plats during 1918 showed the best results from the use of corrosive sublimate as a seed disinfectant. The results as tabulated show the value of planting perfectly clean seed if obtainable, and otherwise of disinfection. Copper sulphate solution, 3 lbs. to 50 gal. of water, has proved valuable in trials extending over four years.

Rotation studies show that disease organisms increase in the soil when a crop is grown continuously. Results secured in 1918 show, further, the value of removing weak and run out plants from the stock which is to be saved for seed. These weak plants produce very poor progeny. More careful handling of potatoes after harvest is also necessary. Rot organisms gain entrance especially through wounds in the tubers, which are brought about particularly by careless handling during and after harvest. Storage bins should be cleaned and disinfected.

Potato diseases (*Meded. Phytopath. Dienst Wageningen, No. 6 (1919), pp. 19, pls. 6, figs. 4*).—Brief accounts are given of potato diseases (and appropriate protective measures), including leaf roll (phloem necrosis or leptonecrosis), Rhizoctonia disease (*Hypochnus solani*), leaf curl (*Verticillium albo-atrum*), mosaic, blackleg (*Bacillus atrosepticus*), late blight (*Phytophthora infestans*) and soil sickness.

Sugar cane matizado or yellow spot, R. DEL VALLE ZENO (*La Enfermedad del Matizado o Manchas Amarillas de la Cana de Azucar. New York: [Author], 1919, pp. 16, pls. 2*).—It is claimed that matizado or yellow stripe of sugar cane is associated with a deterioration of the root system, leading to a diminution of the supply of nutritive materials to the plant. Reference is made to investigations regarding the nature, effects, and possible control of the disease.

Diseases of sweet potatoes, M. T. COOK and R. F. POOLE (*New Jersey Stas. Circ. 123 (1921), pp. 3–24, figs. 17*).—Popular descriptions are given of yellow stem or stem wilt, black rot, soil rot, scurf, and soft rot, all of which are the more important sweet potato field diseases occurring in New Jersey. A number of other diseases are briefly described, and suggestions are given for their control so far as definite means are known.

Glucose as a source of carbon for certain sweet potato storage-rot fungi, J. L. WEIMER and L. L. HARTER (*Jour. Agr. Research [U. S.], 21 (1921), No. 4, pp. 189–210*).—In a contribution from the Bureau of Plant Industry, U. S. Department of Agriculture, the authors give an account of experiments designed to determine to what extent glucose occurring in sweet potatoes can be utilized as a source of carbon by *Fusarium acuminatum, Diplodia tubericola, Rhizopus tritici, Mucor racemosus, Sclerotium bataticola, Penicillium* sp., *Botrytis cinerea*, and *Sphaeronema fimbriatum*.

The different fungi were grown on a modification of Czapek's solution, to which different amounts of glucose were added as a source of carbon. All the fungi, with the exception of *S. fimbriatum*, utilized glucose in considerable quantities. The different fungi varied greatly in the amount of glucose they consumed at the same concentration. In general, the greatest consumption was in the weaker solution (10 per cent) and decreased progressively with the increase of concentration. With two exceptions, all the organisms grew in solutions containing from 42 to 50 per cent of glucose. *Penicillium* sp. alone grew in a 58 per cent solution.

The different organisms varied greatly in the amount of glucose required to produce 1 gm. of dry weight, and likewise, the amount required to produce 1 gm. of dry weight of the same fungus differed with the concentration of the solution. Some of the organisms, particularly *F. acuminatum*, *Sclerotium bataticola*, and *Sphaeronema fimbriatum*, had little or no influence on the hydrogen-ion concentration. On the other hand, the other species increased perceptibly the acidity of the solution.

All of the fungi grew in solutions with a maximum osmotic pressure varying from 81.33 to 101.46 atmospheres. *F. acuminatum* and *M. racemosus* increased the concentration, while the other species in general decreased it. In general, the decrease in the osmotic concentration was found to be not in proportion to the sugar consumed. It is considered possible that compounds such as organic acids, alcohol, etc. were formed from the sugar which would themselves influence the osmotic concentration.

Respiration of sweet potato storage-rot fungi when grown on a nutrient solution, L. L. Harter and J. L. Weimer (*Jour. Agr. Research* [*U. S.*], *21* (*1921*), *No. 4, pp. 211–226, fig. 1*).—In continuation of the above investigation the authors report studies on the availability of glucose as a source of carbon for fungi and upon the amount of carbohydrate used in respiration as measured by the amount of carbon dioxid given off.

All of the fungi, with the exception of *Sphaeronema fimbriatum*, were found able to utilize glucose as a source of carbon. *Penicillium* sp., *Botrytis cinerea*, and *Scelerotium bataticola* produced a maximum of a little more than 2 gm. of carbon dioxid a day. The other fungi formed a relatively small amount.

Three species, *Penicillium* sp., *B. cinerea*, and *S. bataticola*, grew slowly but produced a relatively large amount of dry material and consumed all, or nearly all, of the glucose.

The authors found that the quantity of carbon dioxid evolved was not necessarily correlated with the amount of glucose reduced, nor did the quantity appear to be the equivalent of the theoretical amount that might have been produced from the sugar consumed. The authors claim to have demonstrated for the first time that alcohol is produced by *Fusarium acuminatum*, *Rhizopus tritici*, and *Diplodia tubericola* under the conditions of the experiment.

The present status of the tobacco blue-mold (Peronospora) disease in the Georgia-Florida district, E. F. Smith and R. E. B. McKenny (*U. S. Dept. Agr., Dept. Circ. 181* (*1921*), *pp. 4*).—In order to correct some inaccurate statements regarding the occurrence of this disease of tobacco, the authors state that, so far as known, the disease seems to be confined to the region in which it was first reported (E. S. R., p. 247), and that it has not appeared in Connecticut, North Carolina, nor, so far as the authors are informed, in other districts of Florida or in southern Alabama.

Warning to tobacco growers, E. H. Jenkins (*Conn. State Sta. Bul. Immed. Inform. 15* (*1921*), *pp. 2*).—Attention is called to "wild fire," a bacterial disease of tobacco, and suggestions are given for the treatment of seed beds and young plants for the prevention of the disease.

Plant sanitation in fruit plantations, F. T. Brooks (*Brit. Mycol. Soc. Trans., 6* (*1919*), *pt. 3, pp. 253–262*).—The author deals illustratively with various facts, principles, means, and methods relative to the production of ideal fruit on a commercial scale.

The ammonium polysulphid wash, J. V. Eyre, E. S. Salmon, and L. K. Wormald (*Jour. Bd. Agr.* [*London*], *26* (*1919*), *No. 8, pp. 821, 822*).—Ammonium polysulphid wash, found to be efficacious against the Erysiphaceae, is deemed particularly useful for spraying such parts of plants as fruits, since it leaves no visible deposit on drying.

As a result of investigations carried out at the Southeastern Agricultural College at Wye, it has been found that the fungicidal strength of the ammonium polysulphid wash can be accurately determined by ascertaining the percentage of the polysulphid sulphur that it contains. Investigation during the winter of 1918–19 developed a method for making a stable concentrated solution containing as much as 21.9 per cent of polysulphid sulphur. Such a solution, when made up with water 1:99, proved to be fungicidal for the powdery conidial stage of mildews. It is pointed out, therefore, that three formulas are now available by which the concentrated ammonium polysulphid solution can be made, viz, one which can be diluted 1:20; the 1918 solution (E. S. R., 41, p. 751), to be diluted 1:100; and the 1919 preparation to be diluted 1:200. The preparation of the last mentioned solution is described.

The cause and prevention of the fire blight, C. W. Michel (*So. Dak. State Hort. Soc. Ann. Rpt., 14* (*1917*), *pp. 181–185*).—Brief discussion is given of the character, early known history, life history, and control of fire blight, which is considered perhaps the most destructive disease of fruit trees, attacking pears, apples, and other pomaceous fruits. Resistant varieties and protective measures are indicated.

Peach leaf curl [in Great Britain] (*Jour. Bd. Agr.* [*London*], *26* (*1919*), *No. 8, pp. 823–825*).—Peach leaf curl (*Exoascus deformans*), known in this region for more than a century and very destructive in certain seasons to peaches and nectarines, also more rarely to almonds, is much less prevalent on trees grown under glass than in the open. A description of symptoms is given with directions for control, which is said to be effectual when either Bordeaux or Burgundy mixture is applied before the buds begin to swell in the spring.

A supposed nematode disease of bananas, W. Nowell (*West Indian Bul., 17* (*1919*), *No. 3, pp. 177–179*).—In May, 1918, a serious disease in Grenada of the bluggoe banana, used extensively as temporary shade for cacao, was recognized. An account is given of the characters, nature, and incidence of the disease, which is ascribed to a nematode, of which a description by Cobb is noted below.

A new nema said to cause a serious affection of the bluggoe banana in Grenada, British West Indies, N. A. Cobb (*West Indian Bul., 17* (*1919*), *No. 3, pp. 179–182, figs. 2*).—The nematode attacking bananas as noted above is described under the name of *Tylenchus musicola* n. sp., with discussion of closely related forms.

Some relations of temperature to growth and infection in the citrus scab fungus Cladosporium citri, H. S. Fawcett (*Jour. Agr. Research* [*U. S.*], *21* (*1921*), *No. 4, pp. 243–253*).—In a contribution from the Citrus Experiment Station, Riverside, Calif., the author reports experiments to determine the influence of temperature on scab infection on young sour-orange leaves and on the growth and spore formation of the causal organism.

The conditions found necessary for scab infection were (1) viable spores of the fungus, (2) young citrus leaves of a susceptible species, (3) moisture, and (4) temperatures between 16° and 23° C. The limited range of temperature at which infection of a susceptible host took place under the presumably favorable conditions of the experiment is believed to explain the great differences observed in the occurrence and severity of scab from year to year and from season to season in citrus orchards. It is also believed to explain the differences reported in results of previous inoculation experiments.

Coffee root rot, J. MATZ (*Porto Rico Dept. Agr. and Labor Sta. Circ. 32 (1920), Spanish ed., pp. 5–10, figs. 2*).—A popular description is given of diseases of coffee due to *Rosellinia* sp.

Damping-off in forest nurseries, C. HARTLEY (*U. S. Dept. Agr. Bul. 934 (1921), pp. 99, pl. 1, figs. 20*).—The results are given of an investigation on the causes of damping-off in forest nurseries and of methods for the control of this trouble. Damping-off in nurseries is claimed to be caused mainly by seedling parasites which are not specialized as to host, and as a result of the author's investigations *Pythium debaryanum*, *Corticium vagum*, and *Fusarium* spp. were found to be of probably equal importance. The damping-off of conifers appears to be due principally to these species. Investigations were made as to the susceptibility of 63 species of coniferous seedlings, and it was found that some which were especially susceptible in some nurseries were quite resistant in other localities.

For the control of damping-off the best method thus far tested is the disinfection of the seed-bed soil before or immediately after the seed is sown. Sulphuric acid has been found very useful for the preparation of seed beds for coniferous seedlings.

The results are given of inoculation experiments with a considerable number of fungi found occurring in connection with the growth of seedling trees, showing that thick sowing favors the disease and that soil acidity is, in general, unfavorable to damping-off.

A list of 147 references to cited literature is appended.

Snow breakage and top rot in fir, T. LAGERBERG (*Meddel. Statens Skogsförsöksanst., No. 16 (1919), pt. 5, pp. 115–162, figs. 11*).—Top rot is practically a constant accompaniment of snow breakage in fir forests. It usually develops quickly, particularly in cases of rapidly growing trunks. Stems over 10 cm. (3.9 in.) in diameter often suffer severely. Resin flow and growth may hinder the progress of the rot, and in exceptional cases may stop it entirely.

Corticium evolvens on fir wood, T. LAGERBERG (*Skogsvårdsför. Tidskr., 18 (1920), No. 7–8, pp. 149–167, figs. 4*).—Tabular data and discussion shows the relation of *C. evolvens* to growth in fir.

[Mistletoes and their hosts], C. VON TUBEUF (*Ztschr. Pflanzenkrank., 27 (1917), No. 5–6, pp. 241–287*).—This is a systematic account, including infection studies, of mistletoes on evergreen and deciduous trees.

A drain-blocking fungus, A. L. SMITH (*Brit. Mycol. Soc. Trans., 6 (1919), pt. 3, pp. 262, 263*).—*Fomes ulmarius* was found to have formed a mass weighing about 50 lbs., partly closing a London drain pipe, though no elm was growing in the neighborhood. The fungus was found in four different places and might have lived on coniferous wood found in the vicinity.

Control of root knot, II, J. R. WATSON (*Florida Sta. Bul. 159 (1921), pp. 29–44, fig. 1*).—In continuation of previous publications (E. S. R., 37, p. 453), the author gives additional information regarding the control of root knot due to nematodes. Comments are given on the susceptibility of different host plants and on various methods of control. Root knot was controlled by an application of sodium cyanid solution followed immediately by an application of ammonium sulphate. This method, although probably too expensive for field use, is recommended for the treatment of seed beds, particularly for such plants as are started in the late summer or early fall when nematodes are most active.

ECONOMIC ZOOLOGY—ENTOMOLOGY.

Annual report of the Governor of Alaska on the Alaska game law, 1920, T. RIGGS, JR. (*U. S. Dept. Agr., Dept. Circ. 168 (1921), pp. 18*).—Appended to this report on the status of game and fur-bearing animals and migratory and nonmigratory birds are lists of hunting licenses, special moose-shipping licenses, and general game-shipping licenses issued during the year, and game or trophy shipped from Alaska for private use.

Sixth annual list of proposed changes in the A. O. U. Check List of North American birds, H. C. OBERHOLSER (*Auk, 38 (1921), No. 2, pp. 264–269*).—This list is in continuation of those previously noted (E. S. R., 42, p. 847; 43, p. 50).

Mutanda ornithologica, IX, X, H. C. OBERHOLSER (*Biol. Soc. Wash. Proc., 33 (1920), pp. 83, 84; 34 (1921), pp. 49, 50*).—A continuation of papers previously noted (E. S. R., 42, p. 249).

The migration of North American birds, X–XV, compiled by H. C. OBERHOLSER (*Bird Lore, 21 (1919), Nos. 3, pp. 170, 171; 6, pp. 354, pl. 1; 22 (1920), Nos. 2, pp. 90, 91, pl. 1; 4, pp. 213–216; 6, pp. 343–345; 23 (1921), No. 2, pp. 78–82*).—These papers, in continuation of those previously noted (E. S. R., 40, pp. 254, 646; 41, p. 547), record the migration of the blue jay, Steller's jay, and green jay; Canada jay, Oregon jay, Clarke's nutcracker, and piñon jay; Arizona jay, California jay, and their allies; the European starling and bobolink; cowbirds; and yellowheaded blackbird and meadowlarks, respectively.

A list of the birds of Royal Palm Hammock, Fla., A. H. HOWELL (*Auk, 38 (1921), No. 2, pp. 250–263*).

Food habits of Sceloporus graciosus graciosus (Baird and Girard), H. J. PACK (*Biol. Soc. Wash. Proc., 34 (1921), pp. 63–66*).—Identifications made of the stomach contents of above 70 specimens of the common sagebrush swift, collected in the vicinity of Salt Lake City, Utah, are recorded in tabular form. The results substantiate the common belief that this lizard is insectivorous and beneficial, the red-legged locust having been its chief item of food.

Observations on the insect fauna of permanent pasture in Cheshire, H. M. MORRIS (*Ann. Appl. Biol., 7 (1920), No. 2–3, pp. 141–155, fig. 1*).—"An area was chosen which was as typical as possible of the permanent pasture fields of the district, and in which invasion by insects not belonging to the area would be reduced to a minimum. In order to define the characters of the area under consideration as clearly as possible, chemical, mechanical, and botanical analyses were carried out.

"Insects, largely in immature forms, were obtained by examining samples of soil from various parts of the area, and in addition many adults were obtained by sweeping the herbage with a net. The latter method produced also some invading forms which did not belong to the area. The factors influencing the distribution by depth of the insects in the soil were in this case chiefly occurrence of food, aeration, and moisture, and the result of these influences was that the insects seldom penetrated even as deep as 6 in., the vast majority of specimens being found at a depth not greater than 2 in.

"The census of insects actually found in the samples of soil gave an insect population of 3,586,088 per acre. The family best represented in number of individuals was the Bibionidae, species of which made up 32.4 per cent of the total number of soil insects. The next in number were the Mycetophilidae, 16.7 per cent, and the Staphylinidae, 12.2 per cent. With regard to number of species occurring in the soil, the Coleoptera, with 29 species, was the best represented order."

Entomological drawings and draughtsmen: Their relation to the development of economic entomology in the United States, W. R. Walton (*Ent. Soc. Wash. Proc., 23 (1921), No. 4, pp. 69–99*).

The use of gas-tight fumigation covers, H. J. Quayle and H. Knight (*Calif. Citrogr., 6 (1921), No. 6, pp. 196, 228, figs. 2; also in Calif. Cult., 56 (1921), No. 12, pp. 381, 384, 385*).—This article is based upon work with gas-tight tents, by the senior author, since 1914. It is pointed out that with the use of gas-tight covers the dosage for small trees may be reduced two-thirds, for average sized trees one-half, and for large trees one-fourth, making an average for all trees of about 50 per cent of the schedules now in use. With this reduction in dosage the period of exposure may also be reduced to about 30 minutes to effect results as good as, or better, than those now secured with canvas tents.

"Wind (unless a strong wind) does not interfere with fumigation with gas-tight tents, and the results are not impaired, as is the case even in a slight wind with canvas tents. Humidity or moisture does not increase the injury to the tree, because the gas-tight tent does not vary in gas-holding capacity. The tents also dry more quickly . . . It is possible to determine a constant or dosage for each scale that will apply to any particular district.

"Greater safety from injury to the tree and fruit, because there is less variability in dosage, is insured with gas-tight tents. (This does not apply to work done in sunlight.) With rubberized gas-tight cloth the patching and repair work on tents is easily and quickly done in the field. With the reduction in amount of hydrocyanic acid required, the use of gas-tight covers should eventually reduce the cost of fumigation to the grower."

A volumetric schedule for gas-tight tents, prepared by the senior author, is presented.

The application of vacuum fumigation to fresh and packed dates, D. B. Mackie (*Calif. Dept. Agr. Mo. Bul., 9 (1920), No. 8, pp. 321–324, figs. 2*).—The successful use of a vacuum fumigator for the control of insects infesting dates, particularly the Indian-meal moth and the saw-toothed grain beetle (*Sylvanus surinamensis*), is described.

Eighteenth annual report of the State entomologist of Montana, R. A. Cooley (*Montana Sta. Bul. 139 (1921), pp. 16, figs. 2*).—In discussing current entomological problems, the author deals with grasshoppers; the pale western cutworm, a circular relating to which has been previously noted (E. S. R., 44, p. 757); the fruit-tree leaf-roller [(*Archips*) *Cacoecia argyrospila*]; the alfalfa weevil; and the sugar-beet webworm (*Loxostege sticticalis*). The report concludes with brief notes on other insect pests of the year 1920.

Report of the imperial entomologist, T. B. Fletcher (*Agr. Research Inst. Pusa, Sci. Rpts., 1919–20, pp. 68–94, pls. 7*).—Reporting upon work with borer pests of rice, it is stated that rice stubble in Bengal and Bihar showed a large percentage of infestation by borers, of which *Schoenobius bipunctifer* was the most important, followed by *Chilo simplex*, although *C. oryzae* and *Sesamia inferens* were also implicated. Work with insects of cotton, sugar cane, and mulberry, and with fruit pests, stored grain pests, bees, lac, and silkworms, and life histories of insects are also reported upon.

The Report of the Imperial Pathological Entomologist, by the late F. M. Howlett (pp. 95–108), follows.

Work of the division of entomology, J. F. Illingworth (*Ann. Rpt. Queensland Bur. Sugar Expt. Stats. Ann. Rpt., 20 (1920), pp. 34–39*).—This report relates in large part to work with the grub pest of sugar cane. Other important species mentioned include *Lepidiota albohirta* Waterh., *L. frenchi* Blackb., and *Rhabdocnemis obscura* Boisd.

Some new Orthoptera from Mokanshan, China, A. N. CAUDELL (*Ent. Soc. Wash. Proc., 23 (1921), No. 2, pp. 27–35, figs. 2*).—Two new genera are erected and six species described as new.

Revision of the genus Lygaeus Fab. (Hemiptera-Heteroptera), H. G. BARBER (*Ent. Soc. Wash. Proc., 23 (1921), No. 3, pp. 63–68*).

The mouth parts of the cicada, R. E. SNODGRASS (*Ent. Soc. Wash. Proc., 23 (1921), No. 1, pp. 1–15, figs. 15*).

Notes on the periodical cicada in 1919, R. A. ST. GEORGE (*Ent. Soc. Wash. Proc., 22 (1920), No. 9, pp. 227–231*).—This is a report of observations on the 1919 emergence of brood X of the periodical cicada made at Falls Church, Va., and vicinity. The relation of phenological events in plants and cicada is considered.

Periodical cicadas in Baltimore, Md., E. A. ANDREWS (*Sci. Mo., 12 (1921), No. 4, pp. 310–320*).—This account is based upon observations made during the early summers of 1902 and 1919, particularly the latter year.

Summer control of the chinch bug, J. W. MCCOLLOCH (*Kansas Sta. Circ. 87 (1921), pp. 8, figs. 3*).—This circular deals with dust and oil barriers and their use and operation in Kansas, where, after an absence of six years, this pest has again made its appearance in damaging numbers.

The smallest known leafhopper [Empoasca minuenda n. sp.], E. D. BALL (*Biol. Soc. Wash. Proc., 34 (1921), pp. 23, 24*).—The author describes a minute pale leafhopper found by Moznette to attack the avocado at Miami, Fla.

The life history and successful introduction into California of the black scale parasite, Aphycus lounsburyi How., H. S. SMITH and H. COMPERE (*Calif. Dept. Agr. Mo. Bul., 9 (1920), No. 8, pp. 310–320, figs. 5*).—This is an account of a parasite which was successfully introduced into California from Australia in shipments of black scale material. Up to the time of writing 30,000 specimens had been liberated in various demonstration plats; the species had become acclimated, and was rapidly increasing in numbers.

Technical descriptions are given of the male and female, and studies of its life history and habits are reported on.

The genus Matsucoccus with a new species, F. B. HERBERT (*Ent. Soc. Wash. Proc., 23 (1921), No. 1, pp. 15–22, figs. 10*).—Included in this paper is a description of *M. acalyptus* n. sp. taken from *Pinus monophylla* from southern Idaho.

Studies in North American Cleorini (Geometridae), J. H. MCDONNOUGH (*Canada Dept. Agr., Ent. Branch Bul. 18 (1920), pp. 64, figs. 124*).—In this bulletin the author deals with representatives of 23 genera, 14 genera being erected and 2 given new names.

The corn earworm as an enemy of vetch, P. LUGINBILL and A. H. BEYER (*U. S. Dept. Agr., Farmers' Bul. 1206 (1921), pp. 19, figs. 13*).—This is a popular summary of information on the bollworm as an enemy of vetch, and means for its control. An account of this pest, by the senior author, has previously been noted (E. S. R., 39, p. 764). The pest is the most serious one that growers of vetch have to combat, since the caterpillars eat both the foliage and the seed pods and, if infestation is heavy, make the crop practically worthless. Where intended for a hay crop the vetch usually escapes serious injury, as it is cut before the caterpillars are large enough to do much damage. Spraying, dusting, the use of poisoned-bran bait, and other control measures are discussed.

A recently discovered citrus pest, Platynota tinctana (Walk.) in California, R. S. WOGLUM (*Calif. Dept. Agr. Mo. Bul., 9 (1920), No. 8, pp. 341–343*).—Injury to oranges from short burrows in the rinds, frequently leading to decay, which is familiar to most packing-house managers and to many growers in southern California and has been generally attributed to the orange tortrix (*Tortrix citrana*), has been found to be due to a species identified as *P. tinctana* Walk.

The larva of Popillia japonica Newm. and a closely related undetermined ruteline larva, a systematic and morphological study, A. G. Böving (*Ent. Soc. Wash. Proc., 23 (1921), No. 3, pp. 51–62, figs. 27*).

Synonymical note in Aecophoridae, C. Heinrich (*Ent. Soc. Wash. Proc., 22 (1920), No. 9, p. 232*).

Anaphoidea conotracheli Gir. (Hym.), an egg parasite of the apple maggot, B. A. Porter and C. H. Alden (*Ent. Soc. Wash. Proc., 23 (1921), No. 3, pp. 62, 63*).—This common mymarid parasite of the egg of the plum curculio on various fruits in many localities and also reared from the egg of the grape curculio (*Craponious inæqualis* Say) has been found by the authors to parasitize the eggs of the apple maggot at Wallingford, Conn. Counts made of material collected at that place gave percentages of parasitism ranging from 25 to 30 per cent, indicating that it may prove of great importance in the control of the apple maggot.

A new genus of Bombyliidae, C. T. Greene (*Ent. Soc. Wash. Proc., 23 (1921), No. 1, pp. 23, 24, fig. 1*).—The genus Calopelta is erected for the new species *C. fallax*, from Fort Garland, Colo.

Another anomalous dipteron added to the Rhyphidae, R. C. Shannon (*Ent. Soc. Wash. Proc., 23 (1921), No. 3, pp. 50, 51*).

Description of a new genus of Nemocera, W. L. McAtee (*Ent. Soc. Wash. Proc., 23 (1921), No. 3, p. 49*).

Frit fly (Oscinis frit) in relation to blindness in oats, A. Roebuck (*Ann. Appl. Biol., 7 (1920), No. 2–3, pp. 178–182, pl. 1*).—"From the abundance of evidence obtained last summer I feel justified in suggesting that there may be three broods of frit flies on the oat crop, and that 'blindness' [blind spikelets in the panicles] is caused by the intermediate one. Probably only a certain percentage of the intermediate brood cause this 'blindness,' the remainder entering newly forming tillers. Perhaps the scarcity of suitable tillers, in view of the more advanced condition of the crop and the consequent lessening of the light at the base, compels a certain number to choose the next most suitable site, with the results shown. Exact information on this matter, however, is not available.

"Another site for this brood found in some abundance during 1917 was on the stems of winter wheat. The larvæ were feeding on the stems from the base to at least the third node up, and the pupæ were found in the leaf sheath anywhere between the node and the ligule."

The larvae of the Coccinellidae, J. H. Gage (*Ill. Biol. Monog., 6 (1920), No. 4, pp. 62, pls. 6*).—This paper relates to the morphology (pp. 9–26) and a synopsis of the coccinellid larvae (pp. 27–47). A bibliography of 21 titles is included.

Larva of the North American beetle Sandalus niger Knoch, F. C. Craighead (*Ent. Soc. Wash. Proc., 23 (1921), No. 2, pp. 44–48, figs. 8*).

The structure, bionomics, and economic importance of Saperda carcharies L., "the large poplar longhorn," W. Ritchie (*Ann. Appl. Biol., 7 (1920), No. 2–3, pp. 299–343, pls. 3, figs. 25*).—This is a report of studies of one of the three species of Saperda occurring in Great Britain, of which but two, *S. carcharias* and *S. populnea*, are of economic importance.

S. carcharias attacks vigorously growing, healthy poplar between the ages of 5 and 20 years. *Populus tremula*, which is chiefly an ornamental species is its principal host, but in the absence of this host, or on a sudden increase of the numbers of the pest, other valuable timber-producing poplar species may be endangered. A list is given of 18 references to the literature.

The green June beetle or fig eater, J. J. Davis and P. Luginbill (*North Carolina Sta. Bul. 242 (1921), pp. 3–35, figs. 9; appendix, pp. 8, pls. 3, figs. 6*).—This summary of the present status of knowledge of (*Allorhina*) *Cotinis nitida* L. includes a report of investigations of its life history, habits, and economic status at Columbia, S. C., Louisville, Ky., and Lafayette, Ind.

The adult beetles are frequently reported as injurious to fruit of various kinds, but the grubs are seldom directly injurious to vegetation. Indirectly the grubs may considerably damage garden and field crops, as well as lawns and meadows, by their tunneling and burrowing, uprooting young tender plants, as well as causing the ground to become porous. Lawns are sometimes disfigured and made unsightly by the tunneling of the grubs and by hills of earth thrown up. Instances of injury by the beetle and grubs are given. The species is generally distributed east of the Mississippi River and as far north as St. Louis and Cincinnati in the Mississippi and Ohio valleys and somewhat farther north along the Atlantic coast.

The life cycle of this species is completed in just one year. The adults appear from the last week of June through August, and eggs are deposited soon after their appearance, preferably in soil which has been heavily manured. They hatch ordinarily in two or three weeks. Upon hatching, the grubs tunnel through the soil, feeding on humus, and have a peculiar habit of running their burrows to the surface of the ground, from the open exit of which they throw out little piles of earth resembling ant hills. They continue to feed until cold weather sets in, by which time they are at least two-thirds grown. They do not become completely dormant during the winter, at least not south of latitude 38.5°. Feeding begins as soon as spring opens, and their growth is completed by June, after having molted twice. They then prepare brittle earthen cells within which to pupate, and the first beetles emerge about the last of June or the first of July.

The digger wasp *Scolia dubia* Say is a common parasite of the grubs of this beetle in some localities and materially assists in control of the pest. Three sarcophagid flies have been reared from *C. nitida*, namely, *Sarcophaga sarraceniae* Riley and *S. helicis* Towns. from the adult and *S. utilis* Ald. from partially formed pupae. The mite *Macrocheles marginatus*, the green muscadine fungus (*Metarrhizium anisopliae*), and a bacterial disease caused by *Micrococcus nigro-fasciens* are said to attack it, and numerous birds are listed as feeding upon it.

In discussion of control measures it is stated that in tests made at Louisville, Ky., 80 per cent of the grubs in golf grounds treated with an 8 to 10 per cent kerosene emulsion were killed by a single application, made at the rate of about 1 gal. to 6 or 8 sq. ft. and afterwards thoroughly washed into the soil by copious sprinkling with water.

"Emulsifiable coal tar preparations, which are essentially composed of coal tar oils, phenols, and a saponifying agent, have given very good results against this grub, slightly less effective than kerosene emulsion, but as cheap and much more easily prepared since they readily mix with water. The results of the application of the coal tar products are more evident, since a larger percentage of the grubs come to the surface before succumbing to the action of the insecticide. We find the insecticide appreciably more effective if an additional light sprinkling of it is made after the grubs come to the surface. A material analyzing, approximately, phenols 12 per cent, coal tar oils 53 per cent, water 10 per cent, saponifying agent 25 per cent, should be diluted one part to 125 parts of water and applications and subsequent sprinkling with water should be made as in the use of kerosene emulsion."

Carbon bisulphid is said to be a thoroughly reliable remedy and especially useful on putting greens, but it requires more labor than the other insecticides mentioned. Collecting the beetles is said to have been practiced in some localities. It is recommended that in places where injury is likely to occur chemical fertilizers be used in place of animal manures.

An annotated bibliography of five pages, chronologically arranged, is included. The appendix contains several corrections to the bulletin.

Bionomics of weevils of the genus Sitones injurious to leguminous crops in Britain, D. J. Jackson (*Ann. Appl. Biol., 7 (1920), No. 2-3, pp. 269-298, pls. 5, figs. 6*).—The present paper consists of a detailed report of studies of *S. lineatus* L., the adults of which do their pricipal damage to peas and beans when the plants are from 3 to 6 in. high by feeding upon the leaves, while the larvæ are a source of injury to the root nodules of peas and beans, their injury attaining its maximum at the commencement of the flowering season. The paper includes a brief account of its natural enemies, a key to the 14 British species of Sitones found on leguminous crops, and a bibliograph.

The "piche" or sweet-potato weevil, J. D. More (*Porto Rico Dept. Agr. and Labor Sta. Circ. 34 (1921), Spanish ed., pp. 3-6, pl. 1*).—This is a brief popular account of *Cylas formicarius* Fab., with control measures.

Agentine ant control from an economic standpoint, A. F. Swain (*Calif. Dept. Agr. Mo. Bul., 9 (1920), No. 8, pp. 333-338, fig. 1*).—It is pointed out that by the use of poisoned bait the Argentine ant can be controlled under citrus orchard conditions in southern California at a cost of possibly only 1.25 cts. per tree per year. "The ant is a prime factor in the Riverside district in the abundance of the soft brown scale and has necessitated the great expense of fumigation, which is several times greater than the cost of ant control. It is also a prime factor in the abundance and spread of the Citrophilus mealy bug, which is potentially a very serious orchard pest. The loss in efficiency of labor due to the ant is greater than the cost of ant control."

On the identity of several species of Chalcidoidea (Hymenoptera), A. B. Gahan (*Ent. Soc. Wash. Proc., 22 (1920), No. 9, pp. 235-243*).

Dipterous parasites of sawflies, C. T. Greene (*Ent. Soc. Wash. Proc., 23 (1921), No. 2, pp. 41-43*).—The author has here brought together all the records he has been able to find on this subject, and has added some new breeding records.

FOODS—HUMAN NUTRITION.

The distribution of enzyms and proteins in the endosperm of the wheat berry, F. J. Martin (*Jour. Soc. Chem. Indus., 39 (1920), No. 23, pp. 327T, 328T*).—A study is reported of the nature and extent of the variations in flour from different parts of the wheat berry with respect to enzymic activity and quantity and quality of flour. A single wheat, Barusso Plate, was milled for this experiment, and four samples of reduction flour from different parts of the grain, two of break flours, and one of straight grade flour representing the entire endosperm were used. The enzymic activity was measured by the amount of gas the flour was capable of producing in 24 hours when fermented with a given amount of yeast. Gluten was determined wet and dry after washing out the starch. The gas-retaining capacity of the gluten was determined by measuring the volume of doughs containing identical amounts of gluten from the different sources. Confirmatory baking tests with the different flours were also made. The results obtained are summarized as follows:

"The enzymic activity, as shown by the evolution of carbon dioxid on fermentation, increases progressively from the interior to the exterior of the endosperm. The quantity of gluten increases in the same manner. The quality of the gluten varies considerably, being good in flour from the interior of the endosperm and deteriorating progressively in flour from regions approaching the cortex. The effect of the combination of the increasing quantity with decreasing quality of gluten tends to produce flours of a common 'strength' from various parts of the wheat berry."

An experimental study of the effect of certain organic and inorganic substances on the bread-making properties of flour and on the fermentation of yeast, H. Masters and H. Maughan (*Biochem. Jour., 14 (1920), No. 5, pp. 586–602*).—The authors have investigated the effect of certain organic and inorganic substances on the bread-making properties of flour. The samples of flour represented, in addition to wheat flour of 80 per cent extraction, the various combinations of wheat flour of from 75 to 90 per cent extraction with barley, rice, maize, and rye flours which were used in England during the war. The baking experiments included studies of the effect of the addition of lime water, of alternate reduction and increase in the atmospheric pressure on the expansion of the gluten and of the addition of ox serum, phosphates, and potato alone or combined. Measurements were also made of the amount of fermentation produced by yeast with the various ingredients in the absence of flour and also of the expansion of the dough prior to baking.

The addition of lime water, while neutralizing any acidity in the flour, did not prevent the production of acid and tended to decrease the size of the loaf. It was found impossible to alter the final size of the loaf by stretching the dough through alternate increase and decrease in pressure in a vacuum desiccator.

Fresh ox serum added in 1 per cent concentration caused a marked increase in the volume of the loaf. This property of the serum was found to diminish rapidly on keeping, but was not destroyed by heating to from 50 to 60° C. Gelatin, egg, and blood albumin, caseinogen and lime water, and gelatin alone did not prove satisfactory as substitutes for the ox serum. The addition of phosphates tended to increase the size of the loaf, the maximum increase occurring on the addition of 1 part of monosodium dihydrogen phosphate to 200 parts of the flour. Neither phosphate nor serum produced any increase in the size of the loaf when the bread was raised with chemical raising agents.

In the baking tests with varying proportions of potato, cooked and raw, the best results as to size, texture, etc., were obtained with a mixture containing boiled potato equivalent to from 25 to 33 per cent of the total weight.

The experiments on fermentation of the yeast with the various ingredients whose effect on the properties of the bread was studied in the first part of this investigation and measurements of dough expansion were in general in agreement with the baking experiments, an exception being the results obtained with potato. Raw potato stimulated the action of the yeast to a greater extent than boiled potato, but a larger loaf was obtained with the boiled potato than with raw.

Further work on the bacteriology of swelled canned sardines, W. Sadler, I. Mounce, and E. Shanly (*Roy. Soc. Canada Proc. and Trans., 3. ser., 13 (1919), Sect. V, pp. 135–141*).—This paper, supplementing a previous report (E. S. R., 40, p. 864), deals with an investigation of the possible sources of the bacteria causing the swelling of cans of sardines. Cultural studies were made from the intestines and gills of herrings obtained from weirs, fishing smacks, and canneries along the Atlantic coast from the biological station at St. Andrews, N. B., as a center. Samples were also taken from the water and mud of the weirs and from the water used for the pickling before and after the herrings had been put in.

From material from each of these sources 10 strains of gas-producing bacteria were isolated. These could be classified in three groups, consisting of types of *Bacillus vulgaris*, liquefying gelatin but not fermenting lactose to gas; types of *B. acidi lactici*, *B. aerogenes*, *B. coli*, and *B. communior*, which do not liquefy gelatin but which ferment lactose to acid and gas; and types of the *p*-Gaertner group, which do not liquefy gelatin nor ferment lactose to acid and gas but which produce acid and gas in glucose.

Special attention is called to the observation that without exception the cultures isolated from the intestines of the herrings gave an acid reaction to methyl red, while all the cultures isolated from water in the weirs were alkaline to methyl red.

Twenty-fifth report on food products and thirteenth report on drug products, E. M. BAILEY (*Conn. State Sta. Bul. 227 (1921), pp. 217–283*).—The results of inspection and analysis of foods, drugs, and miscellaneous materials reported, include, among other articles, carbonated soft drinks and similar goods, breakfast foods, "health foods," flour, cocoa, coffee, desiccated products (clam broth, soups, rice pudding, roast beef hash, corned beef hash, and a Welsh rabbit product), diabetic foods, egg shells, egg powder, egg noodles, dehydrated eggs, fats and oils, ice cream, milk and milk products (market milk, cream, a so-called "super-cream," "Imitation Milk" made from skim milk and coconut fat, milk powders, malted milk, and human milk), sirups, tea, and vinegar.

The report on the inspection of soaps includes a discussion of some questions of soap and soap making and of analytical methods.

[Vitamins] (*N. Y. State Jour. Med., 20 (1920), No. 7, pp. 209–225, figs. 4*).—This symposium on vitamins at the annual meeting of the New York State Medical Society on March 24, 1920, consisted of papers on The Antiscorbutic Vitamin, by A. F. Hess (pp. 209–211); The Fat-soluble Vitamin, by L. B. Mendel (pp. 212–217); and The Water-soluble Vitamin, by T. B. Osborne (pp. 217–222), with discussion by E. V. McCollum, C. Funk, L. E. Holt, G. Lusk, and J. Lewi.

The vitamin content of honey and honeycomb, P. B. HAWK, C. A. SMITH, and O. BERGEIM (*Soc. Expt. Biol. and Med. Proc., 18 (1920), No. 2, pp. 70, 71*).—This is a brief note of an investigation of the vitamin content of white clover honey in the comb and of a mixed strained honey. Rats fed on a diet lacking in vitamin B, and others on the same diet in which half of the carbohydrate had been replaced by an isodynamic equivalent of either of these honeys, showed in five weeks an average gain of only 5 gm. in favor of the honey-fed rats. This indicates the presence of a small but negligible amount of vitamin B, a result in agreement with the previously reported conclusions of Dutcher in regard to the antineuritic vitamin in honey as tested on pigeons (E. S. R., 40, p. 564).

The addition of strained honey to diets deficient in A did not induce growth. The addition of comb honey caused distinct gains in weight, indicating the presence of A in the honeycomb.

The addition of 20 per cent of honey to the scorbutic diet of guinea pigs did not prevent or appreciably delay the onset of scurvy, the results thus confirming those of Faber (E. S. R., 44, p. 63).

The effect of heat and age upon the antiscorbutic vitamin in tomatoes, M. H. GIVENS and H. B. McCLUGAGE (*Soc. Expt. Biol. and Med. Proc., 18 (1921), No. 5, p. 164*).—As a further contribution to the value of the tomato as an antiscorbutic agent (E. S. R., 40, p. 762), the authors report that guinea pigs are protected against scurvy by daily doses of 2.5 gm. of fresh raw tomatoes, by 10 gm. of fresh raw tomatoes heated 1 hour at 100° C., by 2 gm. of dried tomatoes heated 15 minutes at 100°, by 10 gm. of tomatoes canned at 15 lbs. pressure for 30 minutes, by 3 cc. of commercial canned tomatoes 3 years old, and by 10 gm. of commercial canned tomatoes, 3 years old, cooked 15 minutes at 100°.

Studies in the physiology of vitamins: Is water-soluble vitamin identical with secretin? G. R. COWGILL (*Soc. Expt. Biol. and Med. Proc., 18 (1921), No. 5, pp. 148, 149*).—This is a brief note of experiments undertaken to throw more light on the question of the possible identity of vitamin B with secretin as suggested by Voegtlin and Myers (E. S. R., 44, p. 765) and others.

A number of extracts which had been tested for vitamin B on polyneuritic pigeons and on dogs which had lost their appetite following a diet lacking in B, were tested for their effect on the flow of pancreatic juice and bile in anesthetized dogs in which the pylorus and the cystic duct were ligated to prevent secretion due to discharge of acid chyme and gall-bladder bile. Extracts of rice polish, wheat embryo, navy bean, yeast, and neutralized tomato juice were tested. Except in the case of tomato juice all of these products gave negative results, while fresh secretin solution in comparatively small amounts injected as controls produced a characteristic and vigorous flow of pancreatic juice and bile.

Preliminary experiments with the fat-soluble vitamin (vitamin A), H. C. SHERMAN, F. L. MACLEOD, and M. M. KRAMER (*Soc. Expt. Biol. and Med. Proc., 18 (1920), No. 2, pp. 41–43*).—This is a preliminary note concerning investigations which are being conducted at the senior author's laboratory on vitamin A in regard to its distribution between the fatty and aqueous phases of milk, significance in growth and reproduction, storage in the body, and heat destruction.

That skim milk contains an appreciable amount of vitamin A has been shown by the satisfactory growth of young rats placed at weaning upon a diet in which dried skim milk was the sole source of vitamins, the restoration of growth and recovery from the characteristic eye disease due to lack of A on the addition of this skim-milk powder to the deficient dietary, and the rapid growth of young rats when white bread which had brought about failure of growth was supplemented by the skim-milk powder.

The experimental results already obtained indicate that the proportion of vitamin A in the food may have quite as striking an influence upon reproduction as upon growth, that the surplus of the vitamin over and above the immediate needs for growth or maintenance is largely stored in the body, and that the vitamin is only very slowly destroyed by dry heating at a temperature of 100° C. with free access of air. "The results thus far obtained emphasize the importance of taking full account of the time as well as the temperature of heating, and of the initial concentration of the vitamin in the food, as well as of the opportunity for previous storage of the vitamin by the test animal."

The cultivation of yeast in solutions of purified nutrients, M. B. MACDONALD and E. V. MCCOLLUM (*Jour. Biol. Chem., 45 (1921), No. 2, pp. 307–311*).—The authors report that they have succeeded in securing the multiplication of three strains of yeast (two baker's and one brewer's) in 15 successive seeds in nutrient solutions of purified chemical substances without the addition of any growth-promoting substance. Quantities of yeast thus grown have been sufficient to furnish from 2 to 5 gm. of dry substance. Two solutions were used, the first consisting of recrystallized sucrose 20, ammonium sulphate 3, potassium dihydrogen phosphate 2, calcium chlorid 0.25, and magnesium sulphate 0.25 gm., dissolved in 1 liter of distilled water. The second solution differed from the first only in that it contained 50 gm. of sucrose per liter. The reagents used were all C. P., and the solutions were sterilized by heating to boiling on two successive days.

The results obtained are thought to indicate that yeast must grow without a specific growth promoting substance, the so-called "bios" or vitamin B, or that it must synthesize the substance to meeet its own needs.

The hygienic valuation of some of the fats recently recommended for edible purposes.—I, Biological and pharmacological studies of hardened plant oils (cottonseed, peanut, linseed, and sesame oil) and of unhardened sesame oil, E. Rost (*Arb. Reichsgsndtsamt., 52 (1920), No. 1, pp. 184–209*).—Observations are reported of the digestibility by dogs of various commercial hardened or hydrogenated oils as judged by gain in weight and general appearance of the animals. The author concludes that the fats tested are eminently suited to human consumption.

The relation of cholesterol to intermediary fat metabolism, W. Hueck and L. Wacker (*Biochem. Ztschr., 100 (1919), pp. 84–99*).—Evidence that cholesterol plays an important rôle in intermediary fat metabolism is presented along the following lines, with confirmatory experimental data:

Cholesterol is a constant accompaniment of animal fat. When added to the food the greater part appears as fatty esters after resorption in the blood. The artificial enrichment of the diet in cholesterol results not only in cholesterolemia, but in an increase in the lipoid fractions, particularly in phosphatids containing fatty acids.

Distribution of zinc in the horse, G. Bertrand and R. Vladesco (*Compt. Rend. Acad. Sci. [Paris], 171 (1920), No. 16, pp. 744–746*).—This contribution to the studies of the distribution of zinc in the animal organism consists of determinations of zinc in the various organs, muscle tissue, skin, etc., of the horse, including determinations on the same material from more than one animal in several cases. The zinc was determined by the calcium zincate method on the ash from 5 gm. of the dried material oxidized with concentrated sulphuric and nitric acids.

The tabulated results show that the organs and tissues of the horse contain notable proportions of zinc, from 3 to 36 mg., per 100 gm. of fresh matter and 12 to 98 mg. per 100 gm. of dry matter. The content of zinc was found to vary not only from one organ or tissue to another, but quite as much in the same organs of different animals. These variations are thought sufficient to explain the discordance in results reported on the same classes of organs by Rost and Weitzel (E. S. R., 42, p. 758), Giaya (E. S. R., 45, p. 64), etc.

Newer aspects of some nutritional disorders, A. F. Hess (*Jour. Amer. Med. Assoc., 76 (1921), No. 11, pp. 693–700, figs. 2*).—In this Harvey Society lecture the author discusses deficiency diseases with particular emphasis on scurvy and rickets. It is pointed out, however, that "the harmful effects of food deficiencies should not be associated in our minds essentially or chiefly with specific diseases such as scurvy or rickets, but rather as disorders of nutrition producing slight and manifold disturbances of function." The chief clinical importance of disorders of nutrition is considered to be a tendency to bring about an abnormal condition of the tissues, rendering them more susceptible to the invasion of bacteria or their products. It is pointed out in this connection that the diseases resulting from prolonged undernutrition in Europe during the recent war are difficult of exact interpretation owing to the number of food factors involved.

The effects of inanition upon the adrenal bodies: Preliminary communication, S. Vincent and M. S. Hollenberg (*Endocrinology, 4 (1920), No. 3, pp. 408–410*).—In this preliminary communication the authors note that they have been able to confirm observations of McCarrison (E. S. R., 41, p. 264) that inanition in pigeons causes hypertrophy of the adrenals, and have also found this to be true in dogs and in rats. In pigeons the adrenals doubled in weight after inanition for 15 days and in dogs after a somewhat longer period. In rats the hypertrophy was considerably greater than in pigeons and dogs, even during a shorter period.

Studies on experimental rickets (*Jour. Biol. Chem., 45 (1921), No. 2, pp. 333–348, pls. 4*).—The two papers presented constitute the first of a series of studies on experimental rickets contributed by the departments of chemical hygiene and pediatrics at Johns Hopkins University.

I. *The production of rachitis and similar diseases in the rat by deficient diets*, E. V. McCollum, N. Simmonds, H. T. Parsons, P. G. Shipley, and E. A. Park (pp. 333–341).—In this paper the formulas are given of certain faulty diets, which when fed to young rats result in the development of pathological changes in the osseous system in some cases identical and in others similar but not identical with those found in rachitic children. Eleven of these diets are described, all of which are deficient in vitamin A or calcium or both. Each has been found to produce in young rats disturbances in the growth and formation of the skeleton, but when fed supplemented with purified food additions to make good the specific deficiencies is capable of inducing approximately normal nutrition and skeletal growth. While suggesting that this indicates that the cause of rickets may lie in a deficiency or failure in metabolism of vitamin A or calcium in the food, the authors are as yet unwilling to draw further conclusions than that the etiological factor is to be found in an improper dietetic régime.

II. *The effect of cod liver oil administered to rats with experimental rickets*, P. G. Shipley, E. A. Park, E. V. McCollum, N. Simmonds, and H. T. Parsons (pp. 343–348).—The experiments reported in this paper furnish direct proof that cod liver oil causes calcium salts to be deposited in the bones. Fifteen young rats were placed on two of the experimental diets described in the previous paper, one low in vitamin A and the other low in Ca, Na, and Cl ions as well as in A. After from 50 to 80 days on these diets and when the animals could apparently live but a few days longer, cod liver oil was added to the rations of 7 of the animals in such proportions that in one diet 2 per cent replaced 2 per cent of dextrin and in the other 1 per cent replaced 1 per cent of maize. The modified diet was fed to 4 animals selected from the first group for 2, 4, 7, and 8 days, respectively, and to 3 from the second group for 3, 5, and 7 days, while the original diet was continued for the other animals until the end of the cod liver oil treatment, when all were killed and the bones examined for gross and microscopic histological changes.

In all of the control animals not receiving cod liver oil the cartilages and metaphyses of the bones were found to be completely freed from lime salt deposits, while in all but one of the animals receiving cod liver oil calcification of the matrix of the proliferative zones of cartilages had taken place.

"The results of this series of preliminary experiments are twofold. They afford ocular and conclusive evidence of the specific beneficial effect of cod liver oil on rats suffering with experimental rachitis, in that some substance or substances in the oil cause calcium to be deposited in the same fashion in which deposition occurs in spontaneous healing of rachitis in man. Moreover, they prepare the way for the elaboration of a new test, which it is to be hoped may eventually prove even to be roughly quantitative, for the determination of the calcium-depositing potentiality of any substance in terms of cod liver oil units. It is especially interesting to note in the present experiments that calcium was deposited in the cartilages following the initiation of the cod liver oil treatment, in spite of the fact that in some cases the calcium intake was far below normal. In view of the fact that in human cases of rickets the blood calcium is maintained throughout the disease at approximately the normal level it is interesting to speculate concerning the source from which the calcium deposited in the proliferative cartilage is derived."

Studies on Bacillus botulinus.—I, Destruction of botulinus toxin by heat, P. F. ORR (*Jour. Med. Research, 42 (1920–21), No. 2, pp. 127–136, figs. 7*).—The resistance to heat of the toxins produced by different strains of *B. botulinus* was tested by heating the toxins prepared under standard conditions in small test tubes in DeKhotinsky electrically heated and regulated oil baths and at regular intervals withdrawing 0.5 cc. portions of the toxin and injecting them intraperitoneally into white mice weighing 20 gm.

All of the toxins tested were found to be comparatively thermolabile. At 80° C. they were destroyed within from 30 seconds to 5 minutes, at 72° within from 2 to 18 minutes, and at 65° within from 10 to 85 minutes. The average temperature coefficient of the destruction of the toxins on increasing the temperature from 65 to 72° was found to be 5.2, while on increasing the temperature from 72 to 80° the average temperature coefficient was 4.2. The toxin produced by the Nevin strain was apparently more resistant to heat than any of the other toxins tested.

Botulism from cheese, M. NEVIN (*Jour. Infect. Diseases, 28 (1921), No. 3, pp. 226–231*).—This paper describes the cultural characteristics and toxin forming powers of the Nevin strain of *Bacillus botulinus*, originally isolated from homemade cottage cheese, which had caused the death of three people in New York in 1914. It is pointed out that "this appears to be the first time that *B. botulinus* has been isolated from cheese, that a soluble bacterial toxin has been detected in cheese, and that *B. botulinus* has been isolated in America."

An outbreak of botulism at St. Anthony's Hospital, Oakland, Calif., in October, 1920, J. C. GEIGER (*Pub. Health Rpts. [U. S.], 35 (1920), No. 48, pp. 2858–2860*).—In this outbreak of botulism, traceable to canned spinach, one of the cases obtained late and treated with botulinus serum A and B recovered, evidently as the result of serum treatment.

ANIMAL PRODUCTION.

Research in animal breeding, I–IV, R. C. PUNNETT (*Jour. Min. Agr. [London], 28 (1921), Nos. 1, pp. 11–17, pl. 1, fig. 1; 2, pp. 110–116, pl. 1, figs. 2; 3, pp. 252–259, pls. 2, figs. 2; 4, pp. 326–334, pl. 1, fig. 1*).—These articles are nontechnical presentations of the elements of animal genetics, the illustrative material being taken mainly from the investigations conducted by the author and his associates. In the first two articles color and horns in cattle are used as simple examples of Mendelism. In the third paper the work on inheritance of weight in poultry (E. S. R., 32, p. 572) and rabbits (E. S. R., 42, p. 763) is cited as illustrating the multiple factor hypothesis, while the fourth paper is mainly an account of sex-linked inheritance.

Leonard Doncaster, 1877–1920, W. B[ATESON] (*Proc. Roy. Soc. [London], Ser. B, 92 (1921), No. B 646, pp. XLI–XLVI, pl. 1*).—This obituary includes a brief survey of Doncaster's contributions to animal genetics and cytology.

Racial investigations.—IV, The genetic behavior of a secondary sexual character, J. SCHMIDT (*Compt. Rend. Lab. Carlsberg, 14* (*1920*), *No. 8, pp. 12, pls. 5, fig. 1*).—The author reports some breeding experiments with an aquarium fish, *Lebistes reticulatus*. A race in which a black spot occurs on the dorsal fin in the male was crossed with a second race in which such spots do not appear. Females never show the spot. It was found that males without the spot produced unspotted offspring exclusively without regard to the race of the mother, whereas all the male offspring of spotted males were similarly spotted. The author points out that the spotted character is distributed exactly like the Y chromosome, and suggests that it is borne on this chromosome. The case appears to be the first in which heredity factors could be assigned to the Y chromosome on the basis of definite experimental work.

A new type of inheritance, W. E. CASTLE (*Science, n. ser., 53* (*1921*), *No. 1371, pp. 339–342*).—The author calls attention to the importance of the paper by Schmidt noted above and speculates on the evolution of the X and Y chromosomes. The type of sex-linked inheritance found in poultry is explained on the assumption that the oögonium contains X and Y and the spermatogonium 2 Ys.

Studies on crossing over.—I, The effect of selection on crossover values, J. A. DETLEFSEN and E. ROBERTS (*Jour. Expt. Zool., 32* (*1921*), *No. 2, pp. 333–354, figs. 2*).—In two series of experiments at the Illinois Experiment Station, it was found possible to reduce the percentage of crossing over between white eye and miniature wing (genes on the sex chromosome) in the female *Drosophila melanogaster* in one case to 0.6 and in the other to 5 or 6. The normal value is about 33. After a number of generations the stocks continued to maintain these lower percentages without further selection. Attempts to select for high crossing over values were not successful, due it is thought to an increased number of double crossovers. The authors do not believe that crossover percentages can be used validly as measures of the distance between genes.

Further studies on the effect of temperature on crossing over, H. H. PLOUGH (*Jour. Expt. Zool., 32* (*1921*), *No. 2, pp. 187–202, figs. 3*).—In an earlier paper[4] the author showed that exposure of female *Drosophila melanogaster* in the late larval stage to high or low temperatures induces a high proportion of crossing over between the genes associated with the second chromosome. The results reported in the present paper show that high temperatures are without effect upon the genes of the first (sex) chromosome, but produce a marked increase in crossing over in the middle region of the third chromosome. The effects of temperature are thought to be similar to the known effects of age on crossing over. Since the chromosomal regions which are "sensitive" to environmental changes also show a high ratio of double to single crossing over, it is suggested that the effects of the environment are most noticeable where crossing over is least free.

Genetical investigations in the crossing of guinea pigs, I, A. PICTET and FERRERO (*Soc. Phys. et Hist. Nat. Genève, Compt. Rend., 38* (*1921*), *No. 1, pp. 32–37*).—In experimental crosses between ordinary short-haired colored guinea pigs and white angora guinea pigs, the authors found that the F_1 were short haired and pigmented, but the hair formed two whorls or rosettes instead of being smoothly distributed over the body. There were 18 types recognized in the 124 F_2 individuals, the large number of types being due to varying expression of the rosette character. The ratios are close to expectation on the assumption of three dominant factors, color, rosette, and short hair. No white angoras appeared in the F_2, but this type was abundant in back crosses.

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[4] Jour. Expt. Zool., 24 (1917), No. 2, pp. 147–209.

Dictyokinesis in germ cells, or the distribution of the Golgi apparatus during cell division, R. J. LUDFORD and J. B. GATENBY (*Proc. Roy. Soc. [London], Ser. B, 92 (1921), No. B 646, pp. 235–244, pls. 2*).—Using the silver nitrate and osmic acid techniques, the author has studied the behavior of the Golgi apparatus during cell division in the testes of rats, guinea pigs, an insect, and several mollusks. Although the Golgi apparatus is an integral part of the cell, it was found that its distribution between daughter cells takes place by a haphazard process of sorting out individual pieces formed by the disintegration of the apparatus during the prophase of mitosis. There was no division of the individual elements, and it is concluded that the Golgi apparatus can have no important part in the hereditary processes.

The heterochromosome problem in vertebrates.—I, Investigation of the early oögenesis of the domestic cat, S. GUTHERZ (*Arch. Mikros. Anat., 94 (1920) pp. 338–364, pls. 2*).—The heterochromosome-like structure observed in oöcytes of the cat by Winiwarter and Sainmont was found not to be a chromosome, but a nucleolus. Its peculiar size and appearance is due to methods of fixation.

Mitoses in the seminal epithelium of the cat, H. DE WINIWARTER (*Arch. Biol., 30 (1919), No. 1, pp. 1–87, pls. 2*).—In the testes of the cat the author finds 34 autosomes and one heterochromosome during the last spermatogonial division. The heterochromosome, which is elongated and often curved, does not divide in the first spermatocyte (reduction) division. It is not visible in resting spermatogonia and is easily distinguishable from the nucleolus, which is spherical and visible in the spermatogonia. The "monosome" described by various authors in the germ cells of the female is thought to consist of the two heterochromosomes in close proximity.

Observations on the interstitial cells are included.

A study of testis and ovary grafts on the hen's egg and their effects on the embryo, T. MINOURA (*Jour. Expt. Zool., 33 (1921), No. 1, pp. 1–41, pls. 10, fig. 1*).—In the author's experiments, pieces of testis or ovary from chickens of various ages were grafted on the chorio-allantoic membrane of developing chick embryos. In a number of cases the implant grew and established vascular connections with the allantoic blood vessels. The following intersexual characters were exhibited in varying degrees by these embryos: (1) The simultaneous existence of gonads of the male type and differentiated Müllerian ducts of the female type; (2) gonads of the male type with the one on the left side enlarged as in a normal female; and (3) persistence of the right gonad in female-type embryos. Grafts of other organs (liver, spleen, thyroid, and thymus) did not produce such conditions.

"Consideration of the experimental data leads us to the following conclusion: The testis and ovary of the chick secrete certain physiological substances, which we may designate sex hormones. When these secretions are introduced into the body of an embryo they exercise a specific effect upon its reproductive system. The development and differentiation of one sex is stimulated by the secretion of the gonad of the same sex and inhibited by the secretion of the gonad of the opposite sex. By means of these secretions the differentiation of sex in the chick can be controlled to some extent. It may furthermore be stated that the two sexes bear a quantitative and not a qualitative relation to each other."

Structures and homologies of freemartin gonads, B. H. WILLIER (*Jour. Expt. Zool., 33 (1921), No. 1, pp. 63–127, figs. 18*).—The author has made an anatomical study of the gonads of 7 fetal freemartins studied by Chapin (E. S. R., 40, p. 466) and 9 freemartins slaughtered after birth at ages ranging from 5 days to 3 years. Six of the latter were furnished by L. J. Cole from the collections of the Wisconsin Experiment Station.

The author accepts Lillie's theory that the freemartin is primarily a female transformed in a male direction under the influence of hormones from the male twin, and recognizes three distinct stages in this transformation. All structures and tissues in the gonads were found to be affected. The sex cords exhibit a series of gradations between medullary cords and seminiferous tubules, the latter complete except for the absence of germ cells. The rete ovarii is transformed into a rete testis by the development of connections between the rete tubules and the seminiferous and epididymal tubules. The epididymis is absent from gonads exhibiting a low degree of transformation; the head alone is present when there is a moderate degree of transformation, while a typical epididymis is present in the highly transformed sex gland. The existence of a graded series is attributed to variability in (1) the time of introduction of the male hormones, (2) potency of the hormones, and (3) the duration of the hormonic action.

The freemartin and its reciprocal, C. G. HARTMAN (*Science, n. ser., 52 (1920), No. 1350, pp. 469–471*).—The author describes an adult sex-intergrade opossum. The external genitalia were those of a male, while internally there were infantile vaginal canals, uteri, and Fallopian tubes. The gonads were situated in the position of the ovaries and consisted of closely packed tubules of uniform size without trace of germ cells.

Nothing is known of the history of this specimen, but it is interpreted as a male that, during the brief gestation period (10 days), developed female characters through the fusion of its chorionic blood vessels with those of a female co-twin. The term reciprocal freemartin is proposed for such a sex-intergrade, and the explanation adopted is frankly based on Lillie's hormone theory (E. S. R., 40, p. 466). Steinach's assumption (E. S. R., 28, p. 173) of antagonistic sex tendencies originating from the presence of both male and female interstitial cells in the embryonic gonad is considered superfluous as an explanation of the freemartin and the reciprocal freemartin types of pseudohermaphroditism.

Sexless twins.—A common form of hermaphroditism in cattle, H. MAGNUSSON (*Arch. Anat. u. Physiol., Anat. Abt., 1918, No. 1, pp. 29–62, figs. 8*).—The author reports anatomical studies of 66 freemartins, usually 2 to 3 years of age, of which 11 are described in detail. The material was secured from slaughterhouses at Malmo, Sweden.

Externally some of the animals were fairly typical females, but practically all showed some male characters in the internal organs, although in only 4 cases were the gonads in or close to the scrotum. Typical seminiferous tubules and interstitial cells occurred in these gonads, but no spermatogenesis. In the remaining cases the gonads were in the position of the ovaries and seemed to be ovotestes. In 37 cases the uterus was well developed and the ductus deferentia were rudimentary.

Four sets of uterine twins were also examined. In two cases the twins were both females, and in one of these the chorions were fused. One pair consisted of a normal male and a normal female, but the chorions were separate and there was no vascular anastomosis. In the remaining case the chorions had vascular connections; one twin was a male with well developed sex organs and the other a "male" with rudimentary organs. Two corpora lutea were found with each pair of uterine twins. The author questions the importance of the fused vascular system discovered by Tandler and Keller (E. S. R., 41, p. 672), and is inclined to adopt the "Mendelian" explanation of freemartins proposed by Hart (E. S. R., 25, p. 474; 33, p. 668).

The internal secretions in growth and development of amphibians, E. Uhlenhuth (*Amer. Nat., 55 (1921), No. 638, pp. 193–221*).—The author reviews the great advances in the knowledge of the functions of the thyroid gland and the hypophysis (pituitary) which have been made in recent years as the result of experiments with amphibians. For such studies amphibians possess manifold advantages over the higher vertebrates, since the early stages are under the control of the investigator. There is a bibliography of about 60 titles.

The bearing of recent research on problems of nutrition, D. G. O'Brien (*Scot. Jour. Agr., 4 (1921), No. 2, pp. 140–148*).—The author discusses the importance of vitamins in animal feeding, and reports briefly a feeding experiment at the West of Scotland Agricultural College in which 48 pigs were fed for 19 weeks on a ration of corn, bran, and middlings, supplemented by whey. An increase in the whey consumption toward the end of the experiment caused an improvement in the rate of growth, but no such improvement was made when the whey was temporarily increased at an early stage, although an increase in the amount of grain at this stage increased the growth. Since the pigs had been on a milk diet prior to the experiment, it is thought that they had an ample reserve of vitamin A and thus derived no benefit from the added vitamins provided by the whey. Later, when the reserve was depleted, growth was promoted by the feeding of more vitamins.

Fodder values, I, II, D. W. Steuart (*Scot. Jour. Agr., 4 (1921), No. 2, pp. 155–164*).—Continuing the paper noted on p. 379, the author applies the feed unit concept to the feeding of pigs and horses, using the tables and discussions in Hansson's manuals. Some of the experiments leading to the formulation of the tables have been noted (E. S. R., 33, p. 471; 34, p. 468; 35, p. 773; 36, p. 370).

The dietetic value of cereals and their products, W. J. Colebatch (*Jour. Dept. Agr. So. Aust., 24 (1921), No. 7, pp. 613–617, 619–623, 625–628*).—This is a discussion of the use of oat, barley, wheat, and rye plants in animal feeding, and includes proximate analyses of (1) the freshly cut plant including two stages of oats and barley, (2) the hay including three stages of wheat, (3) the straw including oat straw cut at three stages, (4) the chaff, and (5) the whole grains and also wheat bran, wheat shorts, brewers' dried grains, and malt coombs. It is stated that cereal silage is being used by sheep farmers in Australia during the autumn rains. Wheat of the macaroni type with semisolid stems in combination with oats is recommended for this purpose.

The composition and digestibility of Sudan grass hay, darso, darso silage, broom corn seed, and sunflower silage, C. T. Dowell and W. G. Friedemann (*Oklahoma Sta. Bul. 132 (1920), pp. 3–8*).—The authors report analyses of feeds and digestion trials with sheep. Collection periods lasted 5 days, and usually a wether, a ram, and a ewe were used in each experiment. The following table summarizes the results:

Composition and digestibility of Oklahoma feeding stuffs.

Feeds.	Composition.						Digestibility (sheep).				
	Water.	Protein.	Ether extract.	Crude fiber.	N-free extract.	Ash.	Dry matter.	Protein.	Ether extract.	Crude fiber.	N-free extract.
	Per ct.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
Darso	11.72	11.76	3.30	3.82	67.47	1.93	72.8	56.5	68.9	(1)	84.1
Broom-corn seed	10.06	13.37	3.64	9.04	59.62	4.27	60.3	33.9	91.9	(2)	69.2
Sudan grass hay	7.92	8.45	1.29	32.45	43.66	6.23	56.1	46.9	57.1	58.8	60.8
Sunflower silage	71.96	2.96	.81	8.67	12.36	3.23	63.7	(2)	65.4	72.5	73.1
Darso silage	73.11	1.91	.34	6.46	16.65	1.54	56.1	[3] 10.3	59.8	(2)	70.4

[1] Negative. [2] Wide range. [3] Average of two determinations; third negative.

The darso and broom corn were fed in conjunction with Sudan grass hay. During the feeding of sunflower silage relatively small amounts were consumed, and defecation was irregular.

The composition and feeding value of silage (*Jour. Min. Agr. [London], 27 (1920), No. 3, pp. 277–281*).—Proximate analyses by G. Williams are reported of single-crop silages made from clover, corn, grass, and Trifolium, and the following types of mixed silage: (1) Grass, tares, and oats; (2) tares and oats; (3) tares, wheat, and oats; (4) tares, oats, rye, and marsh grass; (5) tares, oats, rye, beans, and wheat; and (6) rye, oats, and tares.

A cheap and convenient experimental silo, H. L. Westover and S. Garver (*Jour. Amer. Soc. Agron., 12 (1920), No. 2, pp. 69–72*).—This contribution from the Bureau of Plant Industry, U. S. Department of Agriculture, consists of a brief review of early studies at the State experiment stations on experimental silos, followed by the report of preliminary experiments at the Department field station at Redfield, S. Dak., on the use of motor oil barrels as silage containers.

The materials, consisting of alfalfa, sweet clover, corn, sorghum, Sudan grass, Russian thistle, wild sunflowers, soy beans, corn and alfalfa 1:3, sorghum and alfalfa 1:1, and corn and alfalfa 1:1, were cut in a hand-feed cutter into ⅞-in. lengths and packed tightly into the barrels by trampling and by heaping so that the cover had to be forced in. To further exclude the air the barrel heads were covered with a thick coat of paint. The contents of the barrels weighed from 150 to 200 lbs., depending upon the material and the tightness of packing.

After standing about 3 months the barrels were opened and the contents fed to cattle unaccustomed to silage. All of the materials were eaten readily with the exception of the Russian thistle, which was refused absolutely, and of the wild sunflower, which was eaten very sparingly by one cow. It was thought that the wild sunflower had not fermented properly, probably owing to the presence of resinous substances. The authors conclude that the method may be used advantageously in testing the value of different plants for silage.

The quality of silage produced in barrels, R. Newton (*Jour. Amer. Soc. Agron., 13 (1921), No. 1, pp. 1–11*).—A more elaborate study than the one noted above of the suitability of barrels as containers for experimental silage is reported. The silage materials used were Northwestern Dent corn in the early milk stage of maturity, Mammoth Russian sunflowers with seeds just beginning to develop, corn and sunflowers 1:1, Banner oats in the dough stage, and Silverhull buckwheat with well-developed seeds. All of these crops were frozen September 1, and were cut September 3 and 5. The barrels were filled in the field with the materials cut in ½-in. lengths and firmly packed, each barrel holding about 250 lbs. of the material. The barrels were closed with loose-fitting covers and stored in the basement of the experimental barn until early in the following June. When the barrels were opened for examination, the blackened portion from the top and additional material showing decay were removed and the remainder divided into two portions representing second and first quality silage. Samples of both were analyzed for moisture content, total, nonvolatile, and volatile acidity, and total and amino nitrogen. The analyses reported as compared with samples taken from an ordinary farm silo and published results of silage analyses indicated that the barrel silage was normal in all important respects.

Palatability tests were conducted by feeding to a dairy herd of 10 cows from 8 to 10 lbs. each of the experimental silage in addition to the regular evening feeding of from 15 to 20 lbs. of pea-and-oat silage. The order of increasing palatability, as judged by these tests, was sunflower which was not entirely eaten, buckwheat which was left to be eaten last, corn and sunflower, peas and oats, and oats alone, the last being eaten with avidity before the regular feed.

Report on commercial feeding stuffs, 1920, E. M. Bailey (*Connecticut State Sta. Bul. 229 (1921), pp. 293–323*).—The proximate composition and retail prices are reported of cottonseed meal, cottonseed feed, linseed meal, wheat bran, wheat mixed feed, wheat middlings, rye middlings, corn gluten feed, corn meal, hominy feed, distillers' dried grains, dried beet pulp, peanut oil meal, coconut oil meal, carob beans (including pods), and various proprietary stock feeds, calf meals, and poultry feeds.

Commercial feeding stuffs, A. McGill (*Jour. Assoc. Off. Agr. Chem., 4 (1921), No. 3, pp. 351–360*).—This article deals with Canadian usage in the definition of feeding stuffs, mainly wheat by-products. Little difference has been found in the composition of materials sold as shorts and as middlings, and in many cases because of the low fiber content they conform to the definition of feed flour. It is held that elevator screenings should not be allowed to enter commerce without being inspected for poisonous weed seeds.

Purebred sires lead rapidly to improvement in female stock, D. S. Burch (*Jour. Heredity, 12 (1921), No. 1, pp. 45–48, figs. 3*).—This is a report of the progress of the "better sires—better stock" campaign of the Bureau of Animal Industry, U. S. Department of Agriculture (E. S. R., 42, p. 866). The article is illustrated with halftones of bas-reliefs of early Egyptian cattle and Assyrian horses which indicate that the ancients had live stock that approached modern ideals in conformation.

Scottish purebred live stock, III–VII (*Scot. Jour. Agr., 3 (1920), Nos. 2, pp. 165–174, pls. 4; 3, pp. 295–302, pls. 2; 4, pp. 438–443, pls. 2; 4 (1921), Nos. 1, pp. 31–48, pls. 4; 2, pp. 148–155, pls. 2*).—These five papers continue the two previously noted (E. S. R., 43, p. 171) and deal with the history and characteristics of various Scottish breeds. The titles of the respective papers and their authors are as follows: Galloway Cattle, by F. N. M. Gourlay; Highland Cattle, by J. Cameron; Ayrshire Cattle, by J. Howie; The Clydesdale Horse, by A. MacNeilage; and Highland Ponies, by R. Inglis and J. M. Mackenzie.

Genetics of Hereford cattle, W. E. Castle and W. L. Wachter (*Jour. Heredity, 12 (1921), No. 1, pp. 36–39, figs. 2*).—The authors review the work of Pitt (E. S. R., 43, p. 375) and criticize some of her conclusions on the grounds of undue simplification, particularly in the treatment of muzzle pigmentation and body color. They lament the fact that the frequencies of the different grades of white spotting were not published, and suggest that the factors for excess white and for dark neck may on further analysis prove to be dominant and recessive members, respectively, of the same set of allelomorphs.

Better cattle in the range country, R. R. Hill (*Breeder's Gaz., 79 (1921), No. 2, pp. 59, 60, figs. 2*).—An account of cooperative demonstration work undertaken by the Forest Service of the U. S. Department of Agriculture at the Santa Rita Range Reserve for the purpose of developing a type of range cattle suitable for Arizona conditions.

Cattle feeding investigations, W. L. Blizzard (*Oklahoma Sta. Bul. 134 (1920), pp. 3–7, figs. 3*).—To compare sunflower silage and darso silage for fattening baby beef, 2 lots of seven 425-lb. grade Hereford steers were fed for 150 days, beginning January 16, 1920, on a ration of 11 lbs. of corn, 1.07 lbs. of cottonseed meal, 13 lbs. of silage and 2 lbs. of alfalfa hay. The lot fed sunflower silage made a daily gain of 2.24 lbs. per head and the lot fed darso silage gained 2.29 lbs. Analyses of the two kinds of silage given in Bulletin 132 are repeated.

Some studies in cattle feeding, M. M. Desai (*Poona Agr. Col. Mag., 11 (1919–20), No. 2–3, pp. 77–84*).—The author describes a certain amount of success in feeding durra straw and dried cotton stalks to cattle in Guzerat during a pasture shortage, and reports proximate analyses of these materials and also a number of native grasses (*Andropogon annulatus, Polytoca barbata, Eragrostis cynosuroides, Ophiurus cerymbosus,* and *Iseilema* spp.).

The durra stubble was chaffed and mixed with gul and linseed meal. The cotton stalks, which had been heaped in bundles, had the following percentage composition: Moisture 2.5, protein 11.75, ether extract 6.55, crude fiber 17.15, nitrogen-free extract 49.7, and ash 12.35. Owing to the high tannin content (9.14 per cent) only limited amounts were fed, but the animals voluntarily sought out the bundles in the field.

Sheep feeding investigations.—Comparative rations for fattening wether lambs, W. T. Magee and A. E. Darlow (*Oklahoma Sta. Bul. 133 (1920), pp. 4, fig. 1*).—This is a report of a 96-day lamb-feeding trial begun November 20. The methods of feeding and the results are summarized in the following table:

Results of a 96-day lamb feeding trial.

Lot.	Concentrates fed and daily ration.	Number of lambs.	Initial weight per head.	Daily gain per head.	Consumed per pound of gain.				
					Cottonseed meal.	Kafir products.	Sudan hay.	Alfalfa hay.	Darso silage.
			Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
1	Cottonseed meal (0.375 lb.)	21	60.9	0.199	1.88	(1)	9.29	....	11.51
2	Cottonseed meal (0.55 lb.)	22	58.2	.213	2.58	(1)	8.32	....	9.76
3	Kafir heads (0.84 lb.)	22	55.9	.303	....	2.76	....	6.38	7.21
4	Shelled kafir (0.79 lb.)	22	56.3	.333	....	2.37	....	5.88	6.53
5	Ground kafir (0.91 lb.)	21	58.2	.334	....	3.00	....	9.98	....

[1] Kafir heads fed in limited amounts last 18 days.

Lot 2 went off feed after 70 days, but no losses occurred as a result of the heavy cottonseed meal ration. Lot 1 fed well to the end. Kafir in the head is considered too bulky a feed for lambs. Darso silage, being cheap, increased the profits of lots 3 and 4 in comparison with lot 5.

Methods of feeding sheep during periods of temporary shortage of grazing, W. J. Spafford and E. A. Bristow (*Jour. Dept. Agr. So. Aust., 24 (1921), No. 6, pp. 491–493, 495–498, figs. 2*).—The authors report observations on methods of hand-feeding sheep with chaff and grain for short periods, and conclude that a bag trough is less wasteful than a V-shaped wooden trough. The bag trough consists of old superphosphate bags supported on a framework of lumber and fencing wire.

Accounts of a Hampshire Down flock, A. D. Hall (*Jour. Min. Agr. [London], 28 (1921), No. 2, pp. 104–109*).—In this paper are summarized the cost accounts of a purebred Hampshire Down flock for the year ended September 29, 1920, in continuation of the 1918–19 accounts previously noted (E. S. R., 43, p. 570).

The figures again illustrate the unprofitableness of pedigree ram breeding in England when home-grown feeds are charged at farm prices. Part of the high cost is due to the necessity of crowding lambs for the August shows.

Weight of fleece as related to length of wool, V. O. McWhorter (*Natl. Wool Grower, 11 (1921), No. 3, p. 14*).—In this paper and the two whose titles follow, the author presents and discusses briefly some data collected in the course of the sheep breeding experiments of the U. S. Department of Agriculture. The material is the same as that reported by Marshall (E. S. R., 44, p. 868) with the addition of the 1920 figures.

Length of staple as related to fineness of fleece, V. O. McWhorter (*Natl. Wool Grower, 11 (1921), No. 4, pp. 15, 16*).

Fleece and body weights as related to face covering, V. O. McWhorter (*Natl. Wool Grower, 11 (1921), No. 5, p. 9*).

Some feeding tests with pigs, A. J. Perkins (*Jour. Dept. Agr. So. Aust., 24 (1921), No. 6, pp. 471, 473–475*).—This paper reports a six-week experiment showing increased gains when barley was supplemented by pig meals made of animal waste products put on the South Australian market by the Metropolitan Abattoirs Board. The results are also cited in favor of the author's contention that barley is best marketed through live stock.

Some feeding experiments with dried blood, L. F. Newman (*Jour. Min. Agr. [London], 27 (1920), No. 3, pp. 266–271*).—Four lots of seven 55-lb. pigs were used in this experiment. The lot fed corn meal alone lost 3 lbs. in 11 weeks, while the lot fed corn meal and dried blood made a total gain of 208 lbs. The feeding of wheat offals alone and wheat offals plus dried blood resulted in total gains per lot of 218 and 284 lbs., respectively. The dried blood consumed averaged about 4 oz. per head per day. At the close of the experiment some of the pigs in each lot were continued for four weeks on the experimental ration, half of the pigs receiving a kohl-rabi plant per day in addition. The green feed increased the gains except in the case of the wheat-blood ration.

An experiment with fattening pigs to compare cooked potatoes with raw potatoes (*Ireland Dept. Agr. and Tech. Instr. Jour., 20 (1920), No. 2, pp. 190–193*).—In five experiments in different parts of Ireland in which pigs were fed potatoes and various grain mixtures, it was found that the fattening period was curtailed when the potatoes were cooked.

Pig feeding and the cost of pork production, A. G. Ruston (*Jour. Min. Agr. [London], 27 (1920), No. 4, pp. 340–349, fig. 1*).—The author deplores the decline in pig raising in England and the resulting increase in the import of pork products, and summarizes the accounts of a Yorkshire farm to show that pork production was profitable even in 1918–19, when feeds were abnormally expensive.

Genetics in the crossing of poultry, R. Chodat (*Soc. Phys. et Hist. Nat. Genève, Compt. Rend., 38 (1921), No. 1, pp. 17–21*).—The F_1 of the cross Black Minorca ♂ × White Orpington ♀ resembled the Orpington in body form. The plumage was much like that of the wild jungle fowl, but with an excess of black. Of the F_2 cocks one was pure white, two showed the cuckoo pattern, and four were colored more or less like the F_1 cocks. Of the F_2 pullets one was black and four were white. One white pullet laid white eggs like the Minorca; the other pullets, including the black, laid brown eggs. The author appears to have had no difficulty in classifying the F_2 individuals into Minorca and Orpington types. There was also clear segregation in the color of the tarsus.

Lamona—a new breed of poultry, H. M. Lamon (*Jour. Heredity, 12 (1921), No. 1, pp. 2–29, figs. 27*).—This is a report of the successful issue of an attempt, begun in 1912 by the Bureau of Animal Industry, U. S. Department of Agriculture, to develop a general purpose breed laying white-shelled eggs, by crossing established breeds possessing characters it was desired to combine.

In the first season a White Plymouth Rock cockerel was mated to a Silver Gray Dorking hen, and in the second season Single Comb White Leghorn cockerels were mated to the crossbred pullets and also to Silver Gray Dorkings. Selected offspring of these matings were used for subsequent breeding without further crosses with standard-bred fowls. The breed as finally formed is characterized by long deep bodies, white-shelled eggs, white feathers, yellow legs, four toes, medium-sized combs and wattles, and red ear lobes. The last-named character was secured with considerable difficulty, but was desired as a distinguishing mark to differentiate the breed from the larger type of Leghorn. Various color markings appeared in the course of the experiment, particularly different types of barring, and a pen showing the pyle pattern is being bred.

A footnote by G. M. Rommel states that the Secretary of Agriculture has directed that the breed be named after its originator.

Culling, a practical plan to eliminate the nonproducing hen, W. H. Allen (*New Jersey Stas., Hints to Poultrymen, 9 (1921), No. 9, pp. 4, fig. 1*).—This is an outline of the physical characteristics which are supposed to indicate whether a hen is laying or not in the summer.

Milk a panacea for poultry ills, H. R. Lewis (*New Jersey Stas., Hints to Poultrymen, 9 (1921), No. 8, pp. 4, fig. 1*).—A general statement of the desirability of including milk products in the rations for growing chicks.

Poultry keeping in fruit plantations, G. H. Garrad (*Jour. Min. Agr.* [*London*], *27 (1920), No 4, pp. 350–359*).—The accounts of a 20-acre combined apple, plum, and poultry farm in Kent for five years are presented to show that poultry raising is a profitable adjunct to fruit growing for the small holder.

The importance of the poultry industry to Ireland, L. Murphy (*Ireland Dept. Agr. and Tech. Instr. Jour., 20 (1920), No. 2, pp. 208–216, pls. 2*).—Data are presented showing the exports of poultry, eggs, and feathers from Ireland in 1908, 1909, 1918, and 1919, with particular reference to the export of eggs to Great Britain. Comparable data for other countries and other Irish agricultural products are also included. Increase in winter egg production by improved breeding and feeding methods is considered essential if the export trade in eggs is to be maintained under post-war competition.

A treatise on silver fox farming, F. F. Tuplin (*Alpine, Mich.: Author, 1921, pp.* [*32*], *figs. 10*).—This pamphlet on the feeding and management of silver foxes in captivity is based upon extensive experience of the author in Prince Edward Island and in Michigan.

Aids to successful oyster culture.—I, Procuring the seed, T. C. Nelson (*New Jersey Stas. Bul. 351 (1921), pp. 59, figs. 26*).—This is the first bulletin of a series presenting in condensed form the results of the oyster culture investigations begun in 1888 by the late Julius Nelson and continued since 1916 by the author. A sketch is given of the reproduction of the oyster and the development of the larva, and there is a detailed account of the influence of tides, currents, wind, wave action, salinity, and other factors on the abundance and distribution of the larvae, with notes on the destructive agencies and the depletion of the natural beds. The microscopic examination of the water to determine the distribution of the larvae is considered of prime importance in seed production, so that the cultch can be put down only at spawning places and not scattered broadcast over the bottom. As an aid in this process, directions are given for the collection and examination of water samples.

DAIRY FARMING—DAIRYING.

The rate of growth of the dairy cow.—Extrauterine growth in weight, S. Brody and A. C. Ragsdale (*Jour. Gen. Physiol., 3 (1921), No. 5, pp. 623–633, figs. 3*).—By plotting the monthly average gains against age, the authors found evidence of two postnatal cycles in the growth of Holstein and Jersey heifers at the Missouri Experiment Station. Inspection of the graphs showed that the maximum growth velocity in the first cycle occurred at about the age of 4.5

months in the Holsteins and at about 5 months in the Jerseys. The second cycle in both cases had a rather ill-defined maximum at 20 months.

According to T. B. Robertson the rate of gain in each cycle should follow the equation of an autocatalytic reaction. By means of simple graphical methods and Robertson's tables[5] the authors have fitted such equations to their data. For the first Holstein cycle (9 months) they derived the formula

$$\log \frac{x}{550-x} = 0.158 \ (t-4.5)$$

where t is the age in months and x is the weight in pounds at age t. The equation for the first Jersey cycle (10 months) is

$$\log \frac{x}{444-x} = 0.169 \ (t-5).$$

In these equations the slight gain during the uterine growth cycle is ignored.

A similar equation was fitted to the data on the second Jersey cycle, but owing to the disturbing influence of pregnancy and lactation on growth, the authors do not attach much significance to the results.

Calf feeding experiment (*Ireland Dept. Agr. and Tech. Instr. Jour., 20 (1920), No. 2, pp. 201–204*).—In view of the success with oats in previous calf feeding tests (E. S. R., 41, p. 873) more elaborate experiments were conducted in 21 centers during 1918 and 1919. The 70 calves fed skim milk (with a little whole milk and some buttermilk) and whole oats made a daily gain of 1.32 lbs. per head during an average feeding period of 122 days. The 70 calves fed similarly, but with the oats crushed, gained 1.34 lbs. In one center whole oats caused digestive disturbances, and in another there was difficulty in getting calves to eat the whole oats.

Fodder values for milk recording societies, and dairy herds, D. W. STEUART (*Scot. Jour. Agr., 3 (1920), No. 4, pp. 433–438*).—This is an exposition of the methods of using the Scandinavian feed units (barley equivalents). These are considered better suited to dairy cattle than Kellner's starch values, since the latter were based upon fattening experiments. The data are taken from the manuals of Hansson, whose paper on the extension of the feed unit system to dairy cattle has been noted (E. S. R., 31, p. 371).

Milk recording in Scotland, W. STEVENSON (*Scot. Jour. Agr., 3 (1920), No. 4, pp. 379–391*).—This is an account of the development of official milk tests in Scotland since 1903, with a description of the procedure now used by the Scottish Milk Records Association which was formally organized in February, 1914. Each local society has its resident recorder, approved by the association, who makes one-day visits in rotation to each farm in his circuit. There are provisions for unannounced inspections and "surprise check tests."

"Experience has confirmed the view that a very useful comparison is obtained by reckoning the yields at their estimated equivalent of milk of 1 per cent of milk fat. Such a comparison takes into consideration both the quantity and the quality of the milk. Cows with a milk record equivalent to not less than 2,500 gal. at 1 per cent of fat and heifers with a milk record equivalent to not less than 2,000 gal. at 1 per cent of fat are grouped into Class I. Cows and heifers with milk records of less than two-thirds of these amounts, namely, 1,660 and 1,330 gal., respectively, are grouped into Class III. All cows and heifers with milk yields between these limits fall into Class II."

Publication of the records of all Class I animals, with full particulars of ownership, was started in 1917. In the early days of milk testing owners objected to the publication of records, even of their good cows, but now the value of these records in increasing the prices of cattle is clearly recognized.

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[5] Calif. Univ. Pubs. Physiol., 4 (1915), No. 21, pp. 211–228.

New world record fat producer, F. E. Ellis (*Hoard's Dairyman, 61 (1921), No. 24, p. 935 fig. 1*).—The author reports that the Holstein cow, Bella Pontiac, owned in Ontario, gave 27,017 lbs. of milk and 1,258.4 lbs. of fat in a year's Advanced Registry test completed in June, 1921, thus exceeding the record for fat production hitherto held by Duchess Skylark Ormsby (E. S. R., 34, p. 472).

Dairy farming on arable land (*Liverpool: R. Silcock & Sons, Ltd., pp. 144, figs. 5*).—This volume consists of five essays written, respectively, by J. C. Brown, J. Skinner, H. G. Robinson, W. Petre, and C. L. Coxon, offered in competition for prizes donated by the publishers. The essayists concern themselves particularly with suggestions for soiling systems for dairy cows, but many other aspects of dairy farming in Great Britain are considered.

The milk supply of the city of Edinburgh, A. Cunningham and B. A. Thorpe (*Scot. Jour. Agr., 3 (1920), No. 4, pp. 429–433*).—The bacterial content of 40 samples of market milk collected in Edinburgh in the autumn of 1919 varied from 20,000 to 29,000,000 per cubic centimeter. About half of the samples contained lactose-fermenting organisms in high numbers. A table summarizes published milk counts in other cities throughout the world.

Clarification of milk, C. E. Marshall, E. G. Hood, et al. (*Jour. Dairy Sci., 3 (1920), No. 4, pp. 245–259, fig. 1*).—This is mainly a detailed account of the observations on the physical, chemical, and biological differences between clarified and unclarified milk reported in a preliminary paper (E. S. R., 44, p. 179). In addition to the points there noted, the authors emphasize the disturbances in the associative action of the organisms present that are brought about by the selective removal of the larger ones.

The effect of pasteurizing temperatures on the paratyphoid group, E. M. Twiss (*Jour. Infect. Diseases, 26 (1920), No. 2, pp. 165–170*).—In a series of experiments the author found that various strains of *Bacillus paratyphosus A*, *B. typhosus*, *B. enteritidis*, and *B. suipestifer* survived in milk pasteurized for 30 minutes at 60° C. and then cooled, while some strains of *B. paratyphosus B* survived similar exposure to 65°. The organisms were seldom recovered from plate cultures made immediately after pasteurization, but they were abundant in milk incubated at 37.5° for 24 hours after a period of cooling to simulate commercial practice. The negative results from plate cultures are attributed to the small size of the samples used.

It is thought that only certain very resistant organisms survived the high temperatures and that the greater number died out as the temperature approached 60°.

Sudden physiological mutations in the lactic acid bacteria through individual divergences, C. Gorini (*Compt. Rend. Acad. Sci. [Paris], 172 (1921), No. 22, pp. 1382–1384*).—In pure cultures of *Streptococcus lacticus* and other lactic acid bacteria, the author has found upon several occasions sudden spontaneous changes in the physiological characteristics, particularly in the proteolytic action in milk cultures. In some cases the cultures returned later to their original state. This phenomenon is explained by Richet's principle of individual divergence, and in the author's opinion indicates that a large number of the named species, subspecies, races, types, and varieties of lactic acid bacteria will have to be discarded.

Bacteriological investigations of the so-called yoghurt plants and kefir grains, J. Boersma (*Meded. Rijksseruminricht., 1 (1918), No. 7–8 pp. 344–373, figs. 10*).—The author reports that the growths known as yoghurt plants are true kefir grains, being formed by *Lactobacillus caucasicus B.* Yeast, though present, did not contribute to the structure, and the occurrence of other organisms is accidental. Much published work on the bacterial growths in fermented milks is reviewed.

On molded butter, F. W. J. Boekhout and J. J. O. de Vries (*Centbl. Bakt. [etc.], 2. Abt., 52 (1920), No. 1–3, pp. 39–45, figs. 2*).—This is a report of a cultural and morphological study of a fungus, *Hormodendron cladosporioides* (*Cladosporium herbarum*), found growing in black-green colonies on the surface of storage butter in Friesland.

The mold seldom survived in butter containing more than 2 per cent salt, did not grow in the tub or on the paper, and had very little influence on the chemical composition of the butter. The temperature required to kill the spores in 10 minutes varied in different cultures from 43 to 48.5° C. The low thermal death point is thought to indicate that contamination occurred after pasteurization.

Commercial buttermilk, A. D. Burke (*Milk Dealer, 10 (1921), No. 8, p. 2*).—In experiments with culture buttermilk at the Oklahoma Experiment Station, it was found that wheying off usually occurred unless the acidity developed is between 0.6 and 0.7 per cent. The presence of gas-producing organisms in the starter also caused wheying off, but the viscosity of the culture seemed to be relatively unimportant.

Making American cheese on the farm, C. M. Gere (*U. S. Dept. Agr., Farmers' Bul. 1191 (1921), pp. 19, figs. 14*).—Detailed directions are given for the manufacture of Cheddar cheese on a small scale.

Methods of manufacturing ice cream, O. E. Williams (*Creamery and Milk Plant Mo., 10 (1921), No. 4, pp. 54, 56, 58, 74*).—An outline of methods for ice cream factories making up to 50 gal. per day.

VETERINARY MEDICINE.

Chemical pathology, H. G. Wells (*Philadelphia and London: W. B. Saunders Co., 1920, 4. ed., rev., pp. 695*).—In this fourth edition the subject matter of the preceding edition (E. S. R., 39, p. 79) has been thoroughly revised, particularly the section on reactions of immunity, the growing bulk of material on which has necessitated a rearrangement of material with a separate chapter on anaphylaxis and allergy. There has also been added a chapter on the chemistry of growth and repair, in which is included a brief discussion of vitamins and deficiency diseases.

The presence of microparticles in the blood and other body fluids, S. H. Gage and P. A. Fish (*Jour. Amer. Vet. Med. Assoc., 58 (1921), No. 4, pp. 384–402, figs. 11*).—This is a report presented at the annual meeting of the American Veterinary Medical Association at Columbus, Ohio, in August, 1920.

Diseases, ticks, and their eradication, A. Theiler (*Union So. Africa, Dept. Agr. Jour., 2 (1921), No. 2, pp. 141–159*).—This is a popular summary of the status of knowledge of the subject.

Report of the New York State Veterinary College at Cornell University for the year 1919–20 (*N. Y. State Vet. Col. Rpt., 1919–20, pp. 238, pls. 33*).—The following papers are included in this report: Some Notes Regarding the Selection and Shipping of Material for the Laboratory Diagnosis of Anthrax, Blackleg, and Septicemia Hemorrhagica, by W. A. Hagan (pp. 51–54); Researches upon the Diseases of Breeding Cattle, by W. L. Williams (pp. 55–66); Acute Indigestion in Ruminants, by D. H. Udall (pp. 67–76); Infectious Enteritis of Cats, by H. J. Milks and S. A. Goldberg (pp. 77–91); Coccidiosis in Cattle, by W. D. Way and W. A. Hagan (pp. 92–103); *Pseudomonas pyocyaneus* as a Factor in Pneumonia of Swine, by R. R. Birch and J. W. Benner (pp. 104–118); A Fatal Undiagnosed Disease of Cattle in the State of New York, by W. A. Hagan (pp. 119–127); The Diseases of the Oviduct of the Cow and Their Relation to Sterility, by H. L. Gilman (pp. 128–154); The Occurrence of Epithelial Tumors in the Domesticated Animals (pp. 155–169), and Epidermoid Carcinoma in Domesticated Animals (pp. 170–180), both by S. A. Goldberg; Studies on the Normal Blood of the Domesticated Animals.—I, Total Nonprotein Nitrogen, Urea, Uric Acid, Creatinin, and Sugar per 100 cc. of Blood, by C. E. Hayden and M. Tubangui (pp. 181–192); The Bacterial Content of the Genital Tract of Cattle, and Its Relation to Calf Infection, by C. M. Carpenter (pp. 193–202); A Study of Cloacitis in the Domestic Fowl, by S. A. Goldberg and J. P. Benson (pp. 203–222); Treatment of Side-Bone (Ossification of the Lateral Cartilages) by Shoeing, by H. Asmus (pp. 223, 224); and Hog Cholera, by R. R. Birch (pp. 225–235).

Report of the veterinary service for the year 1918–19, W. Littlewood et al. (*Egypt Min. Agr., Vet. Serv. Ann. Rpt., 1918–19, pp. 39.*)—The first part of this report deals with the occurrence of and work with infectious diseases of live stock, the second part with the work of the veterinary pathological laboratory, and the third part with the work of the School of Veterinary Medicine. A census report on the domestic animals in Egypt during 1918 as compared with 1917 is appended, together with returns of animals slaughtered in abattoirs.

Annual report of the Bengal Veterinary College and of the Civil Veterinary Department, Bengal, for the year 1919–20, P. J. Kerr and A. D. MacGregor (*Bengal Vet. Col. and Civ. Vet. Dept. Ann. Rpt., 1919–20, pp. 4+II+7+IX+2*).—The usual annual report (E. S. R., 42, p. 675).

Annual administration report of the Bombay Veterinary College and Civil Veterinary Department in the Bombay Presidency (including Sind), M. H. Sowerby, G. Taylor, and E. S. Farbrother (*Bombay Vet. Col. and Civ. Vet. Dept. Ann. Admin. Rpt., 1919–20, pp. 41*).—This is the usual annual report (E. S. R., 43, p. 272).

Annual administration report of the Civil Veterinary Department, Madras Presidency, for 1919–20, F. Ware and D. A. D. Aitchison (*Madras Civ. Vet. Dept., Ann. Admin. Rpt., 1919–20, pp. 20*).—The usual annual report (E. S. R., 43, p. 180).

Annual report on the Punjab Veterinary College, Civil Veterinary Department, Punjab, and the Government Cattle Farm, Hissar, for the year 1918–19, H. T. Pease, J. Farmer, et al. (*Punjab Vet. Col. and Civ. Vet. Dept. Ann. Rpt., 1918–19, pp. III+2+18+XVII*).—The usual annual report (E. S. R., 40, p. 676).

The principles of serum and vaccine therapy, S. H. Gaiger (*Vet. Rec., 33 (1921), No. 1698, pp. 65–69*).—A general discussion of active and passive immunity and of the use of serum and vaccine alone and combined for the production of active and passive immunity.

The transmission of specific immune bodies from the mother to the young, K. M. Howell and H. Eby (*Jour. Infect. Diseases, 27 (1920), No. 6, pp. 550–556*).—This study includes experiments on the effects of parturition on the antibody content of the serum of immune rabbits and their offspring, and the duration of immune bodies in the serum of the offspring. Six rabbits, before pregnancy, were immunized, one each against human blood corpuscles, sheep corpuscles, *Streptococcus viridans*, type 2 pneumococcus, meningococcus, and *Bacillus typhosus*. A high degree of immunity was maintained by weekly injections of the immunizing agent during pregnancy, the injections being discontinued after parturition. The serum from two rabbits and their young was examined at weekly intervals for hemolytic amboceptor, serum from four rabbits and their young for bacterial complement fixing bodies, serum from two rabbits and their young for bacterial agglutinin, and serum from one rabbit and its young for opsonin.

Antisheep and antihuman hemolysin was decreased in immunized rabbits after parturition, complement fixing antibodies almost disappeared in all but one of the four rabbits tested, agglutinin decreased in one and remained constant in one, and opsonin decreased in the one rabbit tested. The serum of the young of these rabbits showed in the same order a small amount of hemolysin which decreased rapidly, complement fixing bodies in one case only, some agglutinins but less than in the mother, and low points of opsonic extinction but a persistence of opsinin after 5 weeks. The complement fixing antibodies appeared to be less stable than the other immune bodies studied and less readily transmitted to the young.

A comparison of antigens for bacterial complement fixation, K. M. Howell and R. Anderson (*Jour. Infect. Diseases, 27 (1920), No. 6, pp. 569–575*).—Eight different antigens prepared by various methods were compared as to specificity, anticomplementary and antigenic properties and antigenic range in rabbits immunized against the same bacterial strains that were used for the antigens.

A simple antigen prepared by heating the washed suspension of bacteria in normal salt solution was found to be as satisfactory as the more complicated antigens. The authors are of the opinion, however, that the diversity in the choice of the most satisfactory antigen for different bacteria is such as to make it advisable, before starting an extended bacterial complement fixation study, to determine the antigen best suited for the bacteria used in the test.

Foot-and-mouth disease, G. Moussu (*Rec. Méd. Vét., 96 (1920), No. 7–9, pp. 193–208*).—The author discusses the epidemic of foot-and-mouth disease in Italy and other European countries during 1919–20 and reports the results of attempts to control and ameliorate the disease by immunization methods. These consisted first in hyperimmunizing, by means of repeated subcutaneous inoculation of citrated virulent blood, heifers recently cured of the disease, and using the serum from these animals both as a curative and preventive agent. In the former case subcutaneous or intravenous injections of 50 cc. each of the serum were without effect, the disease in all cases taking its normal course. Subcutaneous injections of the serum into normal animals exposed to the disease postponed the appearance of the disease for about 17 days, thus indicating the production of a very transient immunity.

In a series of experiments in which both serum and virulent blood (2 cc.) were injected simultaneously, the period of incubation was extended on an average to 29 days. In another series in which the virulent blood was injected intravenously the day following the subcutaneous injection of the serum, no signs of the disease appeared beyond an intense fever for several days following the inoculation. This suggested the use of intravenous injections of virulent blood as a substitute for the old method of inocculation by mouth. Experiments reported by collaborators of the author indicated that the intravenous injection of citrated virulent blood can be made without danger, and that such injections, while apparently having no effect on subjects already showing visible signs of the disease, if practiced on apparently well animals produce a benign form of the disease. This method of control is considered the most promising in view of the experiments reported.

The adsorption of the virus of foot-and-mouth disease, H. Vallée and H. Carré (*Compt. Rend. Acad. Sci. [Paris], 172 (1921), No. 3, pp. 185–187*).—The authors report that after shaking a mixture of red blood cells with a suspension of aphthic ephithelium in physiological salt solution the virus is adsorbed by the cells, as shown by the ability of the washed cells to produce the disease on subcutaneous inoculation in cattle. After keeping such cells for 48 hours at temperatures of from 0 to 2° C. they are easily phagocytized by the white corpuscles. Although a single inoculation of the adsorbed virus did not suffice to immunize experimental animals, the authors are of the opinion that this property of adsorption is of considerable significance in suggesting the existence of intraglobular virus in infections in the course of which the microscope does not reveal the existence of a causative organism, and of making it possible to obtain for different diseases caused by filterable viruses phagocytable suspensions suitable for immunization experiments.

Foot-and-mouth disease (*Lancet [London], 1921, I, No. 5, pp. 231, 232*).—This is an editorial discussion of the symptoms, cause, and treatment of foot-and-mouth disease, with a brief history of its appearance at various times in England and of the measures taken there to check and exterminate it.

The treatment of epizootic lymphangitis by heated cultures of cryptococci, FORGEOT (*Bul. Soc. Cent. Méd. Vét., 96 (1920), No. 22-24, pp. 489-496*).—The author treated epizootic lymphangitis by subcutaneous injections at 8-day intervals of an emulsion of cryptococci heated at 65° C. for 1.5 hours and diluted in physiological salt solution to a dose of 5 mg. per cubic centimeter. The doses increased by 1 cc. each from 1 to 5 cc., the average duration of treatment being 57 days. Of the 20 horses thus treated 13 were completely cured, while the other 7 showed no benefit. The author is of the opinion that the procedure, while not universally successful, is at present the method of choice.

Method of preparation and antigenic power of alcoholic extracts of tubercle bacilli, A. BOUQUET and L. NÈGRE (*Compt. Rend. Soc. Biol. [Paris], 83 (1920), No. 21, pp. 922-924*).—In the method described sterilized, washed, and desiccated tubercle bacilli are subjected at room temperature for 24 hours to the action of acetone in the proportion of 0.001 gm. of the desiccated bacilli to 1 cc. of acetone. The mixture is then filtered, and the bacilli, after drying in the oven, are mixed with an equal volume of 96 per cent alcohol and are shaken at intervals for 48 hours and filtered.

The alcoholic extract thus prepared is said to possess a much higher antigenic power than the direct alcoholic extract. In aqueous solution, 1:10, it resists heating at 100° for 15 minutes. After evaporating the alcohol there remains a light grayish-white deposit insoluble in physiological salt solution in which is formed, on shaking, an emulsion of feeble antigenic power. If the precipitate is redissolved in alcohol, a liquid is obtained of the same activity as the original alcoholic extract.

Combating bovine tuberculosis with vaccination, A. EBER (*Ztschr. Tuberkulose 27 (1917), No. 1-4, pp. 263-316*).—This is an extensive review and discussion of the literature on attempts at immunization of cattle against tuberculosis. The conclusion is drawn that there is at present no method of immunization which confers a sufficient immunity against natural tuberculous infection. A list of 295 references to the literature, covering a period through 1914, is appended.

A pleomorphic bacillus from pneumonic lungs of calves simulating Actinomyces, T. SMITH (*Jour. Expt. Med., 28 (1918), No. 3, pp. 333-344, pls. 4*).—This is a report of investigations during the winter of 1917 of a disease of young calves, in which a bacillus was found associated in pure culture with an extensive lobar broncho-pneumonia in calves over four weeks old. This bacillus occurred in the exudate as a minute bacillus in small groups. In cultures it appeared in three forms, namely, as a bacillus, as a coccus-like endospore or arthrospore, and as a conglomerate Actinomyces-like flake or colony with peripheral clubs. It was not appreciably pathogenic when injected into certain small laboratory animals. The author suggests the name *Bacillus actinoides* for it, and leaves it to future investigations to determine whether or not it is specifically identical with Lignières actino-bacillus.

The etiological relation of Bacillus actinoides to broncho-pneumonia in calves, T. SMITH (*Jour. Expt. Med., 33 (1921), No. 4, pp. 441–469, pls. 9, figs. 7*).—This is a report of investigations in continuation of those above noted, conducted during the course of an outbreak of pneumonia among calves belonging to a dairy herd in which about 100 calves are raised annually.

"A broncho-pneumonia of calves in the early months of life is described and its etiology associated definitely with a minute bacillus, *B. actinoides*. *B. pyogenes*, *B. bovisepticus*, and, less frequently, staphylococci and streptococci may appear later in the affected lungs. Subcutaneous injections of cultures of *B. actinoides* produce large indurations ending in necrosis. Similarly intratracheal injections produce circumscribed necroses of lung tissue. The cultivation of *B. actinoides* and its morphological peculiarities have been sufficiently described and illustrated in an earlier publication to insure success on the part of those who attempt to isolate it."

Experiments on the vaccination of sheep, H. A. GINS (*Ztschr. Hyg. u. Infektionskrank., 90 (1920), No. 2, pp. 322–336*).—The author reviews briefly the literature on the vaccination of sheep against sheep pox, and reports results from his own experience indicating that vaccination with sheep-pox virus is entirely feasible, leads to no generalization of the virus but only local manifestation, and results in a protection against fatal doses of the sheep-pox virus.

Two methods of vaccination are recommended, subcutaneous injection and inhalation of fresh virus. The latter method is thought to offer considerable promise as a rapid means of vaccinating a large number of sheep. The possibility is suggested of accomplishing this by placing a number of sheep in a small chamber and saturating the air with the virus by the use of an automatic spraying device operated from without.

Protozoan forms and their relation to diarrhea and colitis in shotes, W. W. DIMOCK (*Jour. Amer. Vet. Med. Assoc., 58 (1921), No. 4, pp. 413–426, figs. 2*).—In studies made by the Kentucky Experiment Station of a disease of shotes, which is apparently the same as the condition commonly classified as intestinal necrobacillosis, infectious necrotic enteritis, infectious colitis, infectious diarrhea, etc., careful examination of the bowel content indicate that certain protozan forms may be important factors in initiating the disease. Microscopic examinations of the intestinal contents have been made of 75 pigs, and the organisms encountered have been identified as *Balantidium coli suis* and *Trichomonas suis*. In considering the evidence, it is concluded that there is quite as much to show that *T. suis* is the primary cause of the disease (infectious colitis) as there is for any of the different bacteria that have been studied.

Investigations of the occurrence of the shote typhoid bacillus in healthy swine and in swine affected with hog cholera, E. TORMANN (*Centbl. Bakt. [etc.], 1. Abt., Orig., 82 (1919), No. 7, pp. 532–559*).—This is a contribution on the question of the primary pathogenicity of this microorganism and on the occurance of bacteria of the colon typhoid group in swine.

Determination of the total volume of erythrocytes and leucocytes in the blood of the horse by means of the hematocrit, L. MONTANDON (*Recherches sur le Volume Total des Erythrocytes et Leucocytes dans le Sang du Cheval à l'Aide de l'Hématocrite. Inaug. Thesis, Univ. Bern, 1919, pp. 25*).—An inaugural thesis in which the variation in percentage of the blood corpuscles found in horses of different ages and sexes is reported upon.

Equine vaccine and serum therapy, H. T. HUGHES (*Vet. Rec., 33 (1921), No. 1704, pp. 193–198*).—This is a general discussion of vaccine and serum therapy with special reference to equine diseases. The article closes with a brief survey of work done along these lines in the British Expeditionary Forces in France.

Blood findings in pulmonary emphysema of horses, E. AUGSBURGER (*Blutbefunde beim Lungendampf des Pferdes. Inaug. Diss., Univ. Bern. 1919, pp. 32*).—This inaugural dissertation reports studies of the blood made in emphysema of the lungs of horses, and includes a list of 25 references to the literature.

A new strain of transmissible leukemia in fowls (strain H), V. ELLERMANN (*Jour. Expt. Med., 33 (1921), No. 4, pp. 539–552, figs. 3*).—"A new strain of fowl leucosis has been transmitted through 12 generations of fowls. An increase in virulence was observed during its passage. This was shown in a shortening of the interval between innoculation and death. The increase in virulence does not affect the number of successful inoculations, which remains approximately constant in from 20 to 40 per cent of the birds employed.

"As with former strains, the disease manifests itself in various forms; i. e., myeloid and intravascular lymphoid types. A single lymphatic case was observed. In several intravascular cases a diminution in the hemolytic power of the serum was established. This phenomenon was absent in a number of myeloid cases.

"Active immunization can not be produced by means of the subcutaneous injection of virulent material. The finding of previous experiments that the virus is filterable has been confirmed. The inoculation of human leucemic material into fowls gave negative results."

Tuberculosis of fowls, B. A. GALLAGHER (*U. S. Dept. Agr., Farmers' Bul. 1200 (1921), pp. 11, figs. 3*).—This is a popular summary of information in which the nature and importance of this affection in fowls are pointed out.

Observations on the effect of ipecac in the treatment of infectious entero-hepatitis (blackhead) in turkeys, H. M. and P. WEGEFORTH (*Jour. Pharmacol. and Expt. Ther., 17 (1921), No. 3, pp. 249–259*).—Investigations by the authors at San Diego, Calif., are said to have demonstrated that infectious entero-hepatitis of turkeys can be cured by the administration of suitable doses of ipecac. "It has also been shown that in turkeys experimentally infected by the feeding of viscera taken from a turkey succumbing of the disease can be prevented from contracting the disease by either the oral administration of the fluid extract of ipecac or by the ingestion of the powdered drug with the food. Further, it can be said that the disease failed to make its appearance among the turkeys on a ranch which for several years previous had been visited by epidemics of the disease in a virulent form, the prevention being attributed to the prophylactic administration of ipecac with the food.

"A routine was established on the ranch whereby any bird showing symptoms of blackhead was immediately separated from the rest of the flock and given by mouth ten drops of the fluid extract of ipecac three times a day. This dosage was continued for three days, after which it was decreased to 10 drops twice a day for three days and later once a day for the same period. After treating 6 or 8 turkeys with ipecac, we found that instead of needing autopsies the birds were recovering and could later be turned back with the flock. Of the 52 young birds forming our supply of clinical material, 32 were attacked by the disease. Under the ipecac treatment, 29 of these recovered completely, making a mortality of less than 9 per cent. Of 5 of the old birds contracting the disease during the same period 3 were cured while 2 were lost; those lost were very severe cases, almost fulminating in character, and succumbed in less than two days. Twenty of the young birds never contracted the disease."

A remedy for mange in white rats, C. Kennedy (*Science, n. ser., 53 (1921), No. 1372, p. 364*).—Experiments at the Minnesota Experiment Station have shown that pine oil applied with a soft brush will cause the parts affected with *Notoedres alenis* to heal very quickly.

Some observations and experiments on insect flagellates, with special reference to artificial infection of vertebrates, C. A. Hoare (*Parasitology, 13 (1921), No. 1, pp. 67–85*).—In experiments on artificial infection of mice with *Crithidia melophagia, Herpetomonas jaculum,* and *H. calliphorae*, the author was unable to confirm the results obtained by A. Laveran and his collaborators, finding no traces of infection or of the presence of any forms of flagellates in the animals experimented upon.

RURAL ENGINEERING.

The development of institutions under irrigation, G. Thomas (*New York: Macmillan Co., 1920, pp. X+293, pls. 2*).—The purpose of this book is to relate the story of the development of irrigation institutions, particularly in the State of Utah. Special attention is drawn to the early history of such development. Chapters are included on individual, partnership, and community canals in early days; the land system; water legislation, 1849–1880; county courts and the control of irrigation water; city control of water; irrigation districts; county water commissioners; district or trial courts and irrigation; supreme court decisions and irrigation; thirty-eight years of irrigation legislation; the Bear River Canal; State irrigation projects and State assistance of private projects; the Carey Act; the Reclamation Service; drainage; and the legislation of 1919.

Report of the Water Conservation and Irrigation Commission for the year ended June 30, 1920 (*N. S. Wales Water Conserv. and Irrig. Comm. Rpt., 1920, pp. 44*).—This report contains data on irrigation areas established and controlled by the State, irrigation schemes under consideration, water conservation works constructed by the State, national works maintained by the commission, artesian and shallow well boring, and licensed works for stock and domestic water supply, irrigation, and other purposes.

The application of water in irrigation, A. C. Jennings (*Rhodesia Agr. Jour., 18 (1921), No. 1, pp. 56–64, figs. 7*).—Practical information on the laying out and preparation of land in a suitable manner for irrigation and on the application of irrigation water with reference to conditions in Rhodesia is given.

Quality of irrigation water in relation to land reclamation, C. S. Scofield and F. B. Headley (*Jour. Agr. Research* [*U. S.*], *21 (1921), No. 4, pp. 265–278*).—Studies conducted by the Bureau of Plant Industry of the U. S. Department of Agriculture on the action of irrigation waters, containing excessive quantities of salts, on soils are reported and discussed.

Attention is drawn to certain irrigated soils which are impervious to water and become hard and difficult to work when dry. As a result of the present investigation the conclusion is reached that the trouble with these soils is not due to sodium carbonate exclusively, but that it may be induced by the so-called neutral salts of sodium as well. When soils containing excessive quantities of sodium chlorid or sodium sulphate were leached with pure water, similar results were produced as when such soils were irrigated with water containing sodium carbonate.

It was also found that this injurious effect of sodium salts is much reduced if the salty soil is first leached with a solution of some salt of calcium or aluminum. A soil so treated may be subsequently leached with pure water without developing the symptoms of a reduced permeability and an alkaline percolate. If the irrigation water contained calcium salts equal to or in excess of the sodium salts, the soil rendered salty by such water was less likely to become impermeable when subsequently leached with pure water or with water containing these salts in the same proportion but in lower concentrations.

The further conclusion is drawn that the quality of irrigation waters should be judged not only by considering the total quantity of the salts in solution or the proportions of the acid radicles, but also the proportion of the sodium to the calcium and magnesium. It is suggested that water, to be safe for long-continued irrigation, should be relatively rich in calcium and magnesium.

Water power in the Union of South Africa, I–III, F. E. Kanthack (*So. African Jour. Indus., 3 (1920), Nos. 8, pp. 717–733; 9, pp. 794–802; 10, pp. 927–932, figs. 2*).—A general review is given of the available water power resources of the Union of South Africa.

Part 1 deals with the topography of South Africa and the hydrographic conditions of the Union, and estimates the volume of water which can be used for future extensions of irrigation. In part 2 data are presented on the area of land at present irrigated and the area capable of being irrigated in the future. The total area irrigated is about 1,378,518 acres, and the area estimated to be potentially irrigable after 1930 is about 1,482,700 acres. Attention is drawn to the premier claim of agriculture for irrigation water, and the conflicting claims of irrigaton and water power, the unsuitableness of irrigation storage works for water-power schemes, and possible sources of water power are discussed. In part 3 the cost of storage and coveyance of water is discussed in detail.

Water-power schemes for the Union, F. E. Kanthack (*So. African Jour. Indus., 3 (1920), Nos. 11, pp. 1043–1051; 12, pp. 1131–1141*).—In the first part of this article the water-power possibilities of some 50 of the rivers of the Union of South Africa are discussed, together with an outline of the water law of the Union relating to power development. Part 2 deals with the water-power possibilities of the Vaal and Orange Rivers.

Hydraulics of the Miami flood-control project, S. M. Woodward (*Miami [Ohio] Conserv. Dist., Tech. Rpts., pt. 7 (1920), pp. 343, pl. 1, figs. 125*).—This report embraces the considerations determining the decision as to the type of protection system to be adopted on the Miami flood-control project and the general matters of a hydraulic nature necessary to be used in the design of structures.

The order of presentation shows (1) the general nature of the problem in the Miami valley, (2) a general comparison of the various flood protection plans considered, (3) a more detailed description of the adopted plan, the way it will function in practice, and its effect upon the activities of the valley, and (4) a thorough detailed technical discussion of the principles, theories, and methods of making the voluminous hydraulic calculations required in developing the details of the plan. These embrace especially the capacities of retarding basins, the flow through outlet conduits, the methods of predicting the effects of retarding basins upon definite floods, the determination of the size of dams, outlets, and spillways, the principles governing the design of channel improvements, and the proper coordination of the different retarding basins and channel improvements.

Contract forms and specifications, A. E. Morgan et al. (*Miami [Ohio] Conserv. Dist., Tech. Rpts., pt. 6 (1918), pp. 192, pls. 3*).—This report brings together the legal documents and specifications prepared for letting the contracts for construction of the Miami Conservancy District.

Results of run-off experiments with muck soil (*Engin. and Contract., 55 (1921), No. 15, pp. 363–365, figs. 1*).—This is an abstract of a paper presented by F. C. Elliott before the Florida Engineering Society, in which experiments on the determination of run-off from muck soils, such as occur in the Florida Everglades, are reported. The principal factors studied were storage and evaporation of moisture, the most advantageous water level for growing crops, and subsidence of muck soils under drainage and cultivation. The apparatus used consisted of a water-tight sheet-iron box 2 ft. square and 4 ft. deep, filled with a section of muck soil in its natural condition, growing grass.

It was found that muck soil has a very important storage capacity for moisture when the water table is at a favorable level. The records of the soil boxes showed in the beginning on virgin muck soil that each 3 in. of soil above water leved was capable of storing 1 in. of rain. Later, after the soil became more compact by tillage and drainage, the storage factor was reduced 1:4, and finally to the ratio of 1:5, which latter has been maintained for the past three years. It is concluded (1) that the storage capacity of muck soil is a drainage factor of considerable value, varying directly as the depths of soil above the water table; (2) that in designing a drainage system for muck land account may be taken of the storage value of the soil, provided ditches of relatively deep section are used and at sufficiently close intervals to secure a good depth of water table and for restoring and preserving the storage value of the soil; (3) that soil storage tends to equalize run-off, and its effect will extend to the main canal system as well as to the lateral system; and (4) that deep soil above the water table is a great protection against flood.

Leveling data showed that subsidence varying in amount from 2 to 3½ ft. took place during six years on drained land in the upper Everglades. Subsidence apparently takes place from the surface downward and is confined almost entirely to the zone above water level. Ditch capacity is reduced by diminished depth and slope. The lower the water table the greater and more rapid was the subsidence, and vice versa. The data indicate that too deep drainage should be guarded against, not only from the standpoint of subsidence but also because muck was found to resist the reabsorption of moisture once it becomes too dry. The kind and intensity of cultivation also affected the amount and rate of subsidence.

On the basis of these studies a drainage layout is suggested for such soils, in which drainage capacities are represented by the equation $D=\frac{12}{1+\sqrt{A}}+16$, in which D is the discharge in cubic feet per second per square mile and A is the area in square miles. In this layout the maximum water level in ditches is to be 1 ft. below the ground surface, the depth of lateral ditches not less than 5½ ft., and their spacing not over ½ mile. The water level is to be reduced before the beginning of the rainy season to not less than 50 in. below the surface. The depth of farm ditches is to be not less than 4½ ft. and the spacing not over 660 ft. "In virgin muck soil 8 ft. or more in depth the ditches should be cut 8 ft. deep in order to have as much as 5½ ft. after three or four years of drainage and cultivation. This minimum depth of 5½ ft. must be preserved, and can be through maintenance from time to time. Where partial subsidence has already taken place allowance may be made accordingly. Ditches within reasonable limits and where practicable should be deep and narrow rather than broad and shallow."

Fourth report of State highway engineer and State engineer of New Mexico, L. A. GILLETT (*N. Mex. Highway and State Engin. [Bien.] Rpt., 4 (1919–20), pp. 108, pls. 25, fig. 1*).—Data are reported and discussed on the work and expenditures of the offices of the State highway engineer and State engineer of New Mexico for the period from December 1, 1918, to November 30, 1920.

Eighth biennial report of the State highway commissioner for the period October 1, 1918, to September 30, 1920, J. Allen (*Wash. State Highway Commr. Bien. Rpt., 8 (1919–20), pp. 169, pls. 10*).—This report contains data on the work and expenditures of the Washington State Highway Commission for the biennial period from October 1, 1918, to September 30, 1920.

Subgrade testing apparatus used by Illinois Highway Department, H. F. Clemmer (*Good Roads, n. ser., 21 (1921), No. 13, pp. 181, 182, figs. 3*).—A description is given of the apparatus and methods used on the Bates experimental road in studying subgrade conditions and behavior of the pavement. These include subgrade testing cylinders and a device for reading the change in position of the bearing plug which follows the downward movement of the pavement and the upward movement of the subgrade.

Investigations on fundamental principles in wood conservation, F. Moll (*Untersuchungen über Gesetzmässigkeiten in der Holzkonservierung. Jena; Gustav Fischer, 1920, pp. [3]+23*).—Studies on the action of inorganic compounds on the fungi which cause decay in wood are reported, the purpose being to establish the fundamental principles of such action as related to the treatment of wood for preservation.

It was found that the poisonous action of salts against wood-destroying fungi is an additive action of the ions. The poisonous ions tested were found to be in the order of their effectiveness, mercury, silver, cadmium, cyanid, copper, zinc, iron, cobalt, chromium, and fluorin. Magnesium and aluminum ions, considered to be the most alkaline and acid ions, respectively, were practically ineffective. The poisonous action was found to depend on the solubility in water of the salt and its ability to disassociate into ions in solution. Each ion possessed a specific poisonous action as well as ability to enter into a specific reaction. The effectiveness of compound ions was found to depend upon the individual action of each of their constituents.

Mixing of other salts with active compounds retarded disinfection or hastened it, but did not influence the final results. The effectiveness of a given quantity of a soluble salt or salt mixture was found to depend solely upon the quantity of active constituents in the solution or mixture and on their specific effectiveness.

It is concluded that these experiments place the use of salt mixtures for the impregnation of wood as a protection against decay and fire on a new scientific basis. As long as the mixed salts do not form insoluble precipitates or complex compounds, each individual ion is concluded to retain its specific effectiveness unchanged, and the effectiveness of the mixture as a whole can be considered as the sum total of the effectiveness of the individual ions or molecules.

The penetration of creosote in various sizes of sawed lumber and round piling, R. H. Rawson (*Amer. Wood Preservers' Assoc. Proc., 16 (1920), pp. 74–77, figs. 4*).—Mathematical and graphic data are presented on the relation existing between the shape of a piece of Douglas fir timber and the depth of penetration on treatment with a given amount of creosote oil. The formula for the penetration of creosote in various sizes of sawed lumber is derived and presented as follows:

$$t=\frac{\frac{b+d}{2}-\sqrt[2]{\left(\frac{b+d}{2}\right)^2-\frac{Pbd}{45.818}}}{2}$$

in which b, d, and t represent the width and depth of the lumber and the depth of penetration in inches, respectively, and P represents the pounds of creosote per cubic foot of wood. A corresponding formula for round timber is presented as follows:

$$t=\frac{D-\sqrt[2]{D^2-\frac{PD^2}{45.818}}}{2}$$

in which D represents the average of the diameters at top and butt.

Effect of storage of cement, D. A. ABRAMS (*Lewis Inst. Struct. Materials Research Lab. Bul. 6 (1920), pp. 28, figs. 10*).—Tests on the effect of storage for periods up to two years of three different lots of Portland cement in different kinds of packages and under different conditions on its concrete and mortar-making properties are reported.

The cements were stored (1) in the laboratory, (2) in the basement of the building, and (3) in a shed in the yard, usually in lots of from 800 to 1,200 lbs. in standard cloth sacks. In one group of tests two brands of paper sacks were also used, and in another group the cloth sack containers were covered with thin layers of either Portland cement or hydrated lime. Tests were made at ages of 7 and 28 days, 3 months, and 1 and 2 years on samples taken immediately upon receipt from the dealer's warehouses and after storage for 3 and 6 months and 1 and 2 years.

The report includes the results of compression tests of about 1,000—6 by 12 in. concrete cylinders, about 1,000—2 by 4 in. cylinders of 1:3 standard sand mortar, and about 500 miscellaneous tests. Tests have been under way for 3½ years. It was found that there was no essential discrepancy between the results of compression tests of 1:5 concrete in the form of 6 by 12 in. cylinders and those of tests on 1:3 standard Ottawa sand mortar in 2 by 4 in. cylinders.

Compression tests of concrete and mortar showed a deterioration in strength with storage of cement for all samples, for all conditions and periods of storage, and at all test ages. The deterioration was greatest for the samples stored in the shed in the yard and least for the samples stored in the laboratory. The basement storage was nearly as severe as that outdoors. The deterioration was greater during the first three months than for the later 3-month periods. A greater deterioration was found in the tests made at the age of 7 days than at 28 days and later test ages. After three months' storage in the shed in the yard, the cement had 80 per cent of its original strength, after six months' storage 71 per cent, after one year's storage 61 per cent, and after two years' storage 40 per cent. The deterioration was probably greater in these tests than would be found in a larger lot of cement stored under similar conditions.

The effect of storage of cement on the concrete or mortar strength seemed to be largely a question of the age at which concrete or mortar is tested. The average concrete strength of cement stored in the shed in the yard when tested at 7 days (for all periods of storage) was 64 per cent of the strength when received from the warehouse, at 28 days 71 per cent, at 6 months 78 per cent, at 1 year 82 per cent, and at 2 years 85 per cent. A somewhat similar relation was found for other storage conditions. It is considered a matter of the utmost importance to note that the strength of concrete is not permanently reduced to the low values found in the 7 and 28 day tests.

For periods up to 1½ years there was no marked difference in the quality of cement stored in cloth and in paper sacks. The two brands of paper sacks gave almost identical results. Only a slight advantage was found from the protection of cement in cloth sacks which were covered by thin layers of cement or hydrated lime.

The most favorable storage condition (in laboratory) and the least favorable (in basement and shed) gave strengths of the same order of magnitude, indicating that the possibilities of improving the storage condition of cement in sacks in this climate is rather limited. Storage of cement prolonged the time of initial and final setting, but only slightly affected the normal consistency. The deterioration of cement in storage appears to be due to absorption of atmospheric moisture, causing a partial hydration, which exhibits itself in reducing the early strength of the concrete and in prolonging the time of setting.

Only a negligible quantity of lumps were formed up to one year's storage. Tests on concrete using only broken lumps of cement gave considerable strength.

Brief discussions of storage of cement on the work and a bibliography on the effect of storage of cement are given.

Determination of the mechanical efficiency of internal-combustion engines, V. L. Maleev (*Gas Engine, 23 (1921), No. 3, pp. 53–58, figs. 5*).—A number of studies on methods for determining the mechanical efficiency of internal combustion engines are described, and related factors, including apparatus, are discussed.

Résumé of [U. S.] Bureau of Standards fuel study, H. C. Dickinson (*Jour. Soc. Automotive Engin., 8 (1921), No. 5, pp. 482–486, figs. 6*).—These studies have included work on fuel characteristics and economy and detonation.

Studies of characteristics and economy with three different grades of gasoline, including aircraft gasoline, commercial gasoline, and aviation gasoline containing about 15 per cent of kerosene showed that under the conditions of the test there was no significant difference in the total consumption of the three fuels when delivering the same number of horse-power hours under the same conditions.

The studies of detonation led to the conclusion that whatever the nature of detonation it is largely dependent upon the timing of the explosion with respect to the position of the piston. This means the regulation of the time at which the maximum rate of burning takes place.

[Official gasoline and kerosene analyses, 1920], R. E. Rose and E. T. Casler (*Fla. Dept. Agr. Quart. Bul., 31 (1921), No. 1, pp. 152–285*).—This section of this report contains the results of official analyses of 1,197 samples of gasoline and 414 samples of kerosene collected for inspection in Florida during 1920, and special analyses of 14 samples of gasoline sent in by firms and individuals.

Implements and machinery, G. S. Henderson (*Agr. Research Inst. Pusa, Sci. Rpts., 1919–20, pp. 18–26*).—The details of accomplishment, fuel consumption, and working costs, including all expenses except depreciation and interest, of a steam plowing tackle and two tractors, covering a period of one year in India, are presented and discussed.

Tractor and implement blue book (*St. Louis: Midland Pub. Co., 1921, pp. 359, figs. 179*).—This is a standard buyers' guide for farm implements and machinery of all kinds.

Nebraska tractor tests, O. W. Sjogren (*Jour. Soc. Automotive Engin., 8 (1921), No. 5, pp. 391–395, figs. 6*).—The important features of the tractor tests conducted at the University of Nebraska are reviewed and typical results summarized to show the weaknesses exhibited by the tractors tested.

The difficulties encountered by tractors are classified into five divisions as (1) engine troubles, which are dependent upon the design of the engine and the correlation of different parts, (2) accessory troubles, which depend upon the choice of the proper accessories and their adaptation to the engine, (3) proper correlation of the parts and the design of the chassis to fit the engine and permit its most efficient use, (4) testing of finished tractors by others than designing engineers to bring out minor difficulties, and (5) rating the tractors to give a liberal allowance for overload.

The Nebraska tractor law and rules for official tractor tests, O. W. Sjogren, E. E. Brackett, C. W. Smith, and F. R. Nohavec (*Nebraska Sta. Circ. 13 (1921), pp. 8, figs. 1*).—This is a revision of Circular 10 of the station (E. S. R., 42, p. 784).

Comparative experimental studies on hay and silage cutters, M. Conti (*Rev. Facult. Agron. y Vet. Buenos Aires, 3 (1920), No. 2, pp. 138–148, figs. 5*).—Studies made in connection with work in progress at the National University of Buenos Aires on the development of the most rational type of knife for hay and silage cutting are reported.

Two general types of cutter are distinguished—(1) those with the knife mounted on a circular revolving frame at right angles to the axis of rotation and (2) those with the knife mounted on a revolving cylinder parallel to the axis of rotation. Tests of four cutters, two of each type, are described. The two right angle cutters and one of the cylinder cutters were of the hand-operated type, and the fourth cutter was a large engine or motor-operated type. One of the right angle cutters had two straight blades and the other had two curved blades of so-called logarithmic spiral shape. The hand-operated cylindrical cutter had one helicoidal shaped blade and the motor-operated cutter two helicoidal shaped blades. The respective operating speeds were 50 to 60, 50 to 60, 100, and 600 r. p. m., and the respective maximum diameters of revolution were 27, 42, 7.3 and 10 in. The knife lengths of the cylinder cutters were 11 and 10.6 in., respectively.

The tests were conducted with dry corn. The quantity of cut stalks from the first three cutters varied with the speeds from 295 to 550 lbs. per hour. Ten stalks were fed at a time to these cutters and 15 stalks to the motor-operated cutter. The amount of mechanical energy utilized by each cutter is shown in the following table:

Mechanical energy absorbed by silage cutters.

Cutter.	R. p. m.	Lengths of cut.	Energy absorbed in cutting.	Energy absorbed at each cut.	Energy absorbed running empty.	Cuts per second.	Cutting force at knife edge.
		Inches.	*Foot-pounds.*	*Foot-pounds.*	*Foot-pounds.*		*Pounds.*
No. 1	64	1.6	171.0	77.3	48.8	2.2	44.0
Do	100	1.6	94.6	28.4	....	3.3	14.5
Do	100	.8	97.3	29.6	....	3.3	
No. 2	64	.8	123.0	55.4	64.9	2.2	29.0
Do	100	.8	73.0	22.2	....	2.2	10.5
No. 3	100	1.6	77.0	45.6	73.0	1.6	24.0
Do	240	1.6	61.0	15.2	....	4.0	8.0
No. 4	600	1.2	723.0	36.2	97.5	20.0	30.0

The mechanical energy absorbed by the three hand-operated cutters was inversely proportional to the speed. About twice as much energy was required by the hand cylinder cutter per cut as by the two other hand machines when operating at the same speed. The spiral-shaped knife cutter was superior to the straight knife cutter. The length of cut apparently did not influence the energy requirements.

The results are taken to indicate the advantage of cutters Nos. 2 and 3, and also the necessity of establishing a definite relation between the geometric form of the knife, a convenient peripheral speed, and the weight of the frame.

Handbook of building construction, G. A. Hool and N. C. Johnson (*New York and London: McGraw-Hill Book Co., Inc., 1920, vols. 1, pp. XLIV+802, figs. 1016; 2, pp.* [2]+*803–1474, figs. 407*).—This work in two volumes is intended to provide the architect, engineer, and builder with a reference covering the design and construction of the principal kinds and types of modern buildings and their mechanical and electrical equipment.

Part 1 deals with design and construction, part 2 with estimating and contracting, and part 3 with mechanical and electrical equipment. Part 1 contains sections on structural theory, designing of structural members and connections, structural data, general designing data, construction methods and equipment, and building materials.

Temperature not affected by ventilation, R. L. Patty (*Swine World, 8 (1921), No. 16, pp. 9, 39*).—In a contribution from the South Dakota Experiment Station, the author describes a test conducted by the farm building ventilation committee of the American Society of Agricultural Engineers on a hog house 80 by 28 ft.

It was found that with over 1,200 cu. ft. of air circulating through the house every minute of the night, changing the air completely every 16 minutes, the temperature remained practically constant although the outside temperature dropped 4 or 5°. There was a difference of from 18 to 25° between the outside and inside temperatures. The house is of the type having low side walls, comparatively low overhead space, and large continuous skylight windows. There were 19 small outside doors opening out of the pens and one opening into an adjoining building. Eight of these doors were doubled on the west part. There were six fresh-air-inlet flues 9 in. in diameter on each side and three pairs of 15-in. out-take flues extending up to three large aerators on top.

Hygrometer readings showed that there was practically no excess moisture in the air. It was also found that the suction effect of the aerators on top was not necessary to maintain air circulation, although it had a decided influence.

RURAL ECONOMICS AND SOCIOLOGY.

Rural problems in the United States, J. E. Boyle (*Chicago: A. C. McClurg & Co., 1921, pp. 142*).—In this book, one of the National Social Science Series edited by F. L. McVey, the author discusses broadly certain rural institutions, the home, the school, the country church, store, bank, and newspaper, and the farm bureau in their relationship to present social and economic problems of rural communities.

Organization of rural community buildings, W. C. Nason (*U. S. Dept. Agr., Farmers' Bul. 1192 (1921), pp. 42, figs. 10*).—This publication is designed to give suggestions as to the financing and control of community buildings. Articles of incorporation, constitutions, and by-laws are offered. The laws of a number of States with regard to such public buildings and directions for the organization and erection of these centers are included.

An American land policy, R. T. Ely (In *America and the New Era. New York: E. P. Dutton & Co., 1920, pp. 127–149*).—This paper is found in a symposium on problems, conditions, and policies of social reconstruction as brought about or affected by the war, edited by E. M. Friedman. The discussion brings out conditions of land ownership, tenancy, and taxation that are said to be more favorable in the United States than in other countries, as well as certain unfavorable features of tenancy and private land settlement. Widespread ownership of land, an established minimum for a farmer's holding such as will enable him to support and educate his family fairly, relatively easy attainment of land ownership, a socialized rural and urban population, and a wide distribution of the increment of land values are suggested as ideals on which to base an American land policy. Definition and classification of the lands of the United States are urged, as are also public ownership of natural resources and strategic and submarginal lands, and the establishment of State and Federal land commissions to promote and regulate tenancy and wise land settlement and to afford better credit facilities.

The drift toward the city, B. H. HIBBARD (In *America and the New Era. New York: E. P. Dutton & Co., 1920, pp. 151–165, figs. 3*).—In these pages of the volume noted above the author discusses changes in the extent of the rural population of the United States on the basis of census data, and points out certain geographic sections where marked changes have taken place. Economic conditions influencing the migration cityward are discussed, and social and educational needs in rural districts are briefly noted. It is concluded, however, that it is not yet time to deplore the farm population situation.

Land settlement, H. A. SMITH (*N. S. Wales Statis. Register, 1918–19, pt. 13, pp. 957–997*).—This report continues information previously noted (E. S. R., 43, p. 191) relating to alienation and occupation of lands in New South Wales for the year ended June 30, 1919, with summaries and comparisons for earlier years.

The agriculture of Utah, F. S. HARRIS (*Utah Sta. Circ. 44 (1921), pp. 32, figs. 19*).—Census and other available data are tabulated and illustrated on maps of the State to show the crops and live stock produced, climate, soils, and other agricultural information.

Has the Belgian Kongo a promising agricultural future? E. LEPLAE (*Rev. Gén. Agron., n. ser., 10 (1920), Nos. 1, pp. 16–26; 2, pp. 88–93; 3, pp. 114–132; 4, pp. 171–187*).—The author answers his question in the affirmative, pointing out three measures which he deems necessary for the agricultural development of this Belgian colonial possession, namely, the establishment of improved means of transportation, encouragement by the administration of colonization by Belgian farmers, and the training of agricultural laborers among the natives.

The question of agricultural labor after the war, G. FRÖLICH (*Jour. Landw., 64 (1916), No. 1–2, pp. 9–22*).—In this article, written during the war, the author holds that wherever possible there must be an extension of acreage of hand cultivated crops in Germany after the war, in spite of the fact that more intensive labor is required than in the production of grains. Such a system of agriculture would require the use of more imported labor, and since the neighboring countries formerly contributing to the labor supply would need all the workers in home fields, German agriculture must look farther eastward, even to the possible utilization of coolie labor.

In regard to the question of home colonization, it is said that many phases of this means of improving the labor conditions at home are as yet undeveloped and indefinite. It is maintained, however, that one advantage involved is that the labor of the youths between 14 and 17 years of age may be used at home in farm workers' colonies, without detriment to the young people and with advantage to the agricultural situation.

Suggestions for a national marketing program for the country's agricultural products, G. LIVINGSTON (*Econ. World, n. ser., 22 (1921), No. 1, pp. 5–7; also in Banker-Farmer, 8 (1921), No. 8, pp. 5, 6, fig. 1*).—The program suggested here includes 11 lines of work, as follows: The establishment of national standards for farm products, government inspection, complete and authentic market reporting, development of foreign markets for surplusses, improvement of methods of handling products during marketing, farmers' cooperative marketing, information as to marketing costs, equal protection of agriculture and industry by the tariff, development of a financial policy, provision of adequate transportation facilities, and regulation of potential monopolies.

Cooperative advertising, a social service as well as a powerful sales force, D. Francisco (*Los Angeles, Calif. Fruit Growers' Exch.* [*1919*], *pp. 23, figs. 13*).—Arguments for cooperative advertising as a means of enlarging the basic market, lowering the cost of selling, spreading the season, commanding competitive markets, and improving the quality of a product are illustrated with statistics and graphs relating to the marketing activities of the citrus fruit industry through a period of years.

The development of prices of agricultural machinery and tools since the outbreak of the war in relation to the business organization of farms, H. Schwanecke (*Mitt. Deut. Landw. Gesell., 35* (*1920*), *Nos. 37, pp. 495–498; 38, pp. 509–512; 39, pp. 518–521; 40, pp. 533–537; 41, pp. 544–549; 42, pp. 558–562*).—Considerable tabulated data with discussion are given here, indicating German exports and imports of agricultural machinery of various kinds before the war, prices of materials used in their manufacture, increases in price and contributing factors, and the effect of recent high prices on the demand. It is stated that the question before the farmer is whether he can afford to pay the high prices demanded, or whether he should modify his business to avoid purchases at the present time.

Study is made of wages, agricultural labor cost, horse labor required, prices of agricultural machinery and supplies, and prices received for products for the period 1910–1913, comparing three size-groups of farms in this respect.

It is pointed out in conclusion that operating costs, taxes and insurance, wages, and expenses for machinery and seed supplies have increased at a greater rate than property values. The cooperative use of machinery is suggested as one feasible method of meeting this item of cost of operation.

Farm records and accounts, H. M. Eliot and H. B. Killough (*Texas Sta. Bul. 264* (*1920*), *pp. 40, figs. 14*).—Four parts of this bulletin discuss inventories, records of sales and purchases, income tax returns, and records of crops and live stock produced and sold as phases of farm accounts, giving sample pages to illustrate methods recommended.

Seasonal labor requirements are discussed as a factor in farm business planning (pp. 31–38) on the basis of data presented from a slightly different point of view in a bulletin previously noted (E. S. R., 38, p. 89).

Part 5 offers a few practical rules of farm arithmetic.

The Market Reporter (*U. S. Dept. Agr., Market Rptr., 3* (*1921*), *Nos. 23, pp. 353–368, figs. 2; 24, pp. 369–384, figs. 3; 25, pp. 385–400; 26, pp. 401–416, figs. 2*).—These numbers offer the usual abstracts of market information to about June 18, 1921. Special articles in No. 23 review the production and consumption of wool in 1920 in Western Europe, North America, and the Southern Hemisphere with comparisons for prewar years, and report this season's acreage of wheat in Italy as approximately the same as the average of five prewar years, while imports have returned to prewar levels.

Characteristics of the market for fruits and vegetables in Pittsburgh are noted in No. 24. No. 25 contains a report on the area of cotton planted in Egypt in 1921, notice of the further extension of the Bureau of Markets radio market news service, and a summary of emergency tariff rates on leading farm products compared with rates of 1913 tariff act.

Suggestions for a national marketing program by G. Livingston, noted on page 395 from another source, are offered in No. 26, together with a summary of 1920 apple production, prices, and movement.

Monthly Crop Reporter (*U. S. Dept. Agr., Mo. Crop Rptr., 7* (*1921*), *No. 6, pp. 61–72, figs. 3*).—The usual monthly estimates of acreage and condition of important crops, summaries, brief articles, and tabulations of data as to stocks, farm value, and the prices received are given in this number.

Figures based on reports received from country banks in answer to a question as to interest rates for short-time loans to farmers are tabulated by States and grand divisions as of April, 1912, 1913, 1920, and 1921. They indicate that the Georgia average rate for 1921, 10.36 per cent, is the highest of any State average, and is about 73 per cent higher than the lowest State average, 6 per cent, reported from several North Atlantic States. It is shown, however, that the present spread in the different sections of the country is not quite so wide as formerly.

Illinois crop report (*Ill. Dept. Agr. Circ. 292 (1920), pp. 51*).—Revised statistics for 1919, together with statistics of acreage and yields, prices of important crops, and wages of farm labor for 1920 as secured cooperatively by State and Federal authorities are given here by districts and counties. Brief notes on the winter wheat and rye sown in the fall of 1920 are offered, and special tables are included which indicate the relative importance of Illinois as the third agricultural State of the Union.

[Agricultural statistics for the Netherlands] (*Jaarc. Konink. Nederlanden, Rijk Europa, 1915, pp. 213–228; 1916, pp. 193–208; 1917, pp. 200–214; 1918, pp. 202–216; 1919, pp. 206–220*).—The pages noted of these volumes continue agricultural statistics previously noted (E. S. R., 36, p. 393).

[Agricultural statistics of Sweden] (*Statis. Arsbok Sverige, 8 (1921), pp. 68–91*).—These pages add statistical summaries and comparisons for later years to the series previously noted (E. S. R., 44, p. 492).

[Land tenure and settlement and agricultural and pastoral production in Australia], G. H. Knibbs (*Off. Yearbook Aust., 13 (1901–1919), pp. 261–420, figs. 6*).—These pages continue information previously noted (E. S. R., 42, p. 894).

Agricultural and pastoral statistics, M. Fraser (*New Zeal. Gaz., Sup., 1920, pp. 3309–3347*).—Tabulated statistical data are published here, showing by counties and districts of New Zealand for the season 1919–20 the area sown to the principal crops, actual yields, total area in cultivation and in occupation, numbers of live stock, numbers of farm employees, and the number and power of the various classes of farm machinery on holdings over one acre in extent.

AGRICULTURAL EDUCATION.

Semicentennial history of the University of Illinois.—I. The movement for industrial education and the establishment of the university, 1840–1870, B. E. Powell (*Urbana, Ill.: Univ. Ill., 1918, vol. 1, pp. XXII+631, pls. 20, fig. 1*).—This volume of the semicentennial history of the University of Illinois, with an introduction by E. J. James, deals with the movement for industrial education and the establishment of the University of Illinois, 1840–1870. It includes the Illinois plan for a system of land-grant colleges, its introduction into Congress and enactment into law, and sketches of the lives of the men who led in this movement. An appendix contains documents from which much of this material was obtained.

Wisconsin, J. F. A. Pyre (*New York: Oxford Univ. Press, 1920, pp. [VII]+419, pls. 13 fig. 1*).—This is a history of the University of Wisconsin, including an account of the early settlement of the State of Wisconsin.

Massachusetts independent vocational schools in operation July 1, 1920 (*Mass. Dept. Ed. Bul., No. 7 (1920), pp. 120*).—This bulletin is a revision of that published in 1914 (E. S. R., 32, p. 288). It comprises a summary of the number of schools according to type; laws under which the schools are operated; a descriptive catalogue of all State-aided vocational schools, including, among others, 2 day industrial schools for girls, 1 evening industrial school for women, 10 day homemaking schools for girls, 29 evening practical art classes for women, 6 separate agricultural schools, 15 agricultural departments in high schools, and 11 evening or short unit course agricultural departments; courses offered; and conditions of admission.

Some of the possibilities of the rural school survey, G. W. Stone (*Wis. Teachers' Assoc. Proc., 66 (1919), pp. 201–211*).—Information on how district surveys were made and used in the schools of Dane County, Wis.

The organization of agricultural instruction in the Republic of Mexico based on the establishment of farm schools, R. Escobar (*Rev. Agr. [Mex.], 5 (1920), No. 7, pp. 548–556, fig. 1*).—This is an outline of a project, together with general regulations, for the establishment of farm schools, as approved November 11, 1920, by a council of the chiefs of the General Direction of Agriculture. This is to be in force until December, 1921, when a meeting of delegates from the different farm schools that may have been established is to discuss necessary modifications.

Horticulture: Report on the State gardening school and horticultural schools for 1919 (*[Norway Landbruks Dept.] Landbruks Direkt. Ber. Tillaeg G, 1920, pp. G–107, figs. 20*).—This is a detailed report on the work of the gardening and horticultural schools in Norway in 1919.

Symposium of garden supervisors from coast to coast. Baltimore, Pittsburgh, Cincinnati, Louisville, St. Louis, Kansas City, Seattle (*Nature-Study Rev., 17 (1921), No. 3, pp. 103–120, figs. 3*).—This symposium comprises the following articles: Home Gardens of Baltimore, by A. Derringer; Gardening in the City School Curriculum, by J. A. Hellinger; School Ground Improvement Resumed in Cincinnati, by L. Lamarre; Extracts from the Supervisor's Report, Louisville, Ky., by E. Yunker; Functioning the School Garden with the Home Garden, by H. C. Irish; School Gardening Viewed Vocationally [in Kansas City, Mo.], by C. L. Quear; Notes from a Home Garden Supervisor [in Seattle], by H. Seaman; and Nature Gardens in New York City, by V. E. Kilpatrick.

Illinois school garden section (*Ill. State Teachers' Assoc., Jour. Proc. 66 (1919), pp. 170–181*).—This is a brief report of the meeting of the school garden section of the Illinois State Teachers' Association on December 30, 1919, including a paper on The Normal Plan, by C. F. Miller, which describes the plan of organization and work of the children's garden club at the Illinois State Normal University, Normal, Ill., organized eight years before, and which had enrolled 549 active members who tilled over 20 acres of land.

Children's gardens in a steel town, L. S. Thomas (*Nature-Study Rev., 17 (1921), No. 3, pp. 131–141, figs. 3*).—The author describes the children's garden work instituted in 1913 by the welfare department of the U. S. Steel Corporation in the city of Duquesne, Pa.

The small agricultural fair, O. E. Remey (*Mass. Dept. Agr. Circ. 17 (1920), pp. 23*).—This is a discussion of the organization and activities of the agricultural community fair and its mission in encouraging production, solving farm labor and marketing problems, keeping boys and girls on the farm, providing entertainment, etc.

Interesting the farmer in education, J. L. Dunbar (*Ill. State Teachers' Assoc., Jour. Proc. 66 (1919), pp. 125–130*).—This is a statement of some of the practical things undertaken by the schools to-day to arouse the interest of the farmer by concrete applications to the various activities of farm life.

Natural history studies: An anthology from the author's own works, J. A. Thomson (*New York: Henry Holt & Co., 1921, pp. [VIII]+244, figs. 30*).—This book consists of selections from the author's own works, arranged by seasons.

Be patriotic, vote for a national tree (*Nature-Study Rev., 17 (1921), No. 3, pp. 123–127, fig. 1*).—Descriptive notes are given on nature lessons in the study of trees in an endeavor to educate the voters in the eighth grade of the schools of Washington, D. C., in the selection of a national tree in a national campaign launched by the American Forestry Association.

Elementary home economics, M. L. Matthews (*Boston: Little, Brown & Co., 1921, pp. XX+343, figs. 105*).—This book, arranged for use in the elementary schools, comprises projects in (1) sewing and textiles, involving the selection of clothing and garment making, and (2) foods, their selection, preparation, and preservation, and the planning of meals from the nutritive aspect and economic viewpoint. Lessons on the house and its care are correlated with the other work whenever possible. Laboratory exercises, home problems, and reference questions are included.

Foods and cookery and the care of the house, M. L. Matthews (*Boston: Little, Brown & Co., 1921, pp. XVI+189, pl. 1, figs. 44*).—This volume, which is intended for classes beginning the study of the subject, deals with foods and their selection, food preparation, and meal planning. Preliminary lessons in cookery precede the "projects," making up the major part of the book, which, besides the three meals, breakfast, luncheon, and dinner, include food preservation, Christmas lessons, and supplementary lessons dealing with the care of the house and food for the sick. Home problems are included in order that the home and school work may be correlated.

Many illustrations and a full index add to the usefulness of the volume.

Household mechanics in the Detroit public schools, E. L. Bedell (*Manual Training Mag., 22 (1921), No. 10, pp. 316–323*).—The author describes the one-year course in household mechanics which is replacing the manual training course in the eighth grade of the public schools in Detroit. The purpose of the course is to present a study of the structure and materials of a modern dwelling house and to teach the use and maintenance of all household appliances. A detailed outline of the course, together with lists of the necessary equipment, is given.

NOTES.

Michigan College and Station.—The State appropriation for the ensuing biennium aggregated $990,000, the largest sum in the history of the institution. This amount is equally divided between the two fiscal years, and embraces $140,000 for the cooperative agricultural extension work, $400,000 for the construction and equipment of a home economics building, and $450,000 for a library building.

Several revisions in the curriculum have been adopted, effective with the new academic year. These changes afford opportunity for a wider choice among courses, particularly by juniors and seniors. In dairying, new courses are offered in dairy barn management, market milk production, and dairy farm management. Courses are also offered in stock judging and dairy and beef cattle. Other changes involve additional work in farm mechanics and farm crops, and a general course in genetics, which is to be fundamental to all similar work in other departments.

The home economics courses have also been reorganized so that students may now take general science work with a minimum of home economics subjects; a technical course for training teachers, dietitians, extension specialists, and similar professional workers; or a general home economics course to prepare for teaching in elementary and secondary schools, social service workers, teachers in related fields, and home making. The departments of household science and household arts have been combined, the entire instruction force being designated as professors, associate or assistant professors, or instructors in home economics.

The resignations are noted of Miss Coral R. Havens as extension specialist in home economics, effective June 20; C. W. Waid as extension specialist in potatoes and vegetables, effective March 31; and Ezra Levin as research associate in soils and muck crops, effective June 30. Dr. C. H. Burgess, professor of poultry husbandry and poultry husbandman, has resigned, effective January 1, 1922, and has been granted leave of absence until that time.

Frank Davenport has been appointed assistant in bacteriology, beginning July 1.

Washington College and Station.—The first units of the new poultry plant, consisting of a colony laying house 24 by 30 ft. and a colony brooder house 12 by 24 ft., are now under construction. In addition, contracts have been let for a 2-story incubator house 38 by 60 ft., a 2-story feed house 30 by 40 ft., a breeding and laying house 16 by 196 ft., a brooder house 16 by 120 ft., and an additional colony brooder house 12 by 24 ft. The plant will be constructed in units so that it may be added to as the future may require. It will be used as a laboratory for instruction in poultry, both for vocational and college students, and for experimental work in breeding and poultry production.

It is expected that the buildings will be completed at the opening of the college year.

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EXPERIMENT STATION RECORD.

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Funds for the support of agricultural education and research in this country continue to be almost wholly of public origin. This is not surprising in view of the elaborate system of institutions built up by the Federal and State Governments. None the less a considerable number of individuals have from time to time evidenced their interest and belief in these activities by private contributions.

About ten years ago an attempt was made in these columns[1] to assemble data regarding these contributions, and numerous instances were mentioned of appreciable and timely assistance which had been afforded by private aid. It was brought out, for example, that several substantial bequests considerably antedated the passage of the original Morrill Act of 1863. The contribution of relatively small sums of money by Mr. Orange Judd in Connecticut in 1873 and Prof. Levi Stockbridge in Massachusetts in 1878 was also cited as largely instrumental in initiating experimental work in these States and thereby paving the way to a comprehensive national experiment station system.

The last decade has not brought many gifts of outstanding importance, but the record is by no means barren. In the field of collegiate instruction, perhaps the largest in amount has been a $1,000,000 fund received in 1916 by the Delaware College for general purposes from a donor whose name has been withheld. This gift has enabled the institution to erect several new buildings and increase its endowment funds, thereby greatly improving the facilities for agricultural instruction as well as other phases of its work.

A grant of $250,000 by the General Education Board was made in 1912 to the George Peabody College for Teachers at Nashville, Tenn., to establish the Seaman A. Knapp School of Country Life. This gift was contingent on the raising of an equal sum by the institution, and led to the development of this school, which now offers courses in agriculture, rural education, rural economics, home economics, and related sciences and arts, and operates what is known as the Knapp Demonstration Farm.

A notable bequest, estimated at about $4,000,000 in value, was announced in 1920 following the death of Mr. Ohio C. Barber. The bulk of his estate was left to five trustees with instructions to found the Ohio C. Barber Agricultural and Industrial School on his two-thousand acre farm at Barberton, Ohio. The will provided for "education along agricultural and industrial lines and all things pertaining thereto, for the benefit of men and women of this and of succeeding generations to aid them in becoming industrious and useful citizens, and especially looking to the development of proper treatment of soil as well as to the development of manufacturing industries connected and affiliated therewith."

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[1] E. S. R., 25, p. 401.

The transfer to the State of Vermont of the agricultural school at Lyndon, with land and equipment valued at $150,000, was effected by its founder, Mr. Theodore N. Vail, in 1914. In 1917 a farm of 130 acres at Newington, Conn., on which about $50,000 had been expended for improvements, was tendered the Connecticut College for school purposes by Mr. Austin C. Dunham.

Two gifts to local communities for agricultural work have been reported. One of these was an elaborate farmers' club house, dedicated in 1914 at Seymour, Ind., as a memorial to Capt. Meedy W. Shields, founder of the town and donor of the funds utilized in erecting the building. The second was a bequest by Mr. Clinton C. Haynes of an estate of $20,000 in the town of Wilmington, Vt., "for the benefit of agriculture in said town." The investment of the fund was required, the income being annually applied for lectures, experiments, and other purposes tending to promote the agricultural interests of the community.

Private contributions for experimental purposes have not infrequently taken the form of gifts of land. Thus, Purdue University has received three important gifts of this sort. The first of these was the so-called Moses Fell Annex, comprising two tracts of 360 and 120 acres each at Bedford in southern Indiana, and donated by Hon. Moses F. Dunn in 1914. One of these tracts contained extensive limestone quarries yielding considerable revenue. The chief restrictions imposed by the bequest were its utilization primarily for experimental and demonstration purposes, and work along these lines in horticulture, animal husbandry, and soil and crop improvement has been in progress for several years.

The second tract was given the university in 1919 by Mr. William E. Pinney and his daughter, Mrs. Myra P. F. Clark, as a means of "permanent service to the agriculture and country life of northern Indiana." This tract consisted of two parcels, the Pinney-Purdue Farm and the Pinney-Purdue Soil Experimental Field, of 400 and 67 acres, respectively, and is being used to study various agricultural problems of the region.

The third tract consists of 385 acres of virgin forest land in Randolph County, and does not become available until December 1, 1921.

This property, given by Mrs. Henry Davis and known as the Henry Davis Forestry Farm, is required to be maintained as a forest preserve and refuge for wild life. Commercial cuttings are not permitted, but it is expected to carry on experiments in the acclimatization of useful plants.

In 1917 the West Virginia Station received a bequest from Mr. Lawrence A. Reymann of an estate of over 900 acres of improved land, well equipped with buildings and with 125 head of purebred Ayrshire cattle, the entire plant being valued at about $120,000. The purpose of the gift as stated is to promote, develop, and advance the science of agriculture in its most comprehensive scope, and in addition to give special attention to the breeding and development of Ayrshire cattle.

In several other States individuals or communities have provided land for the experiment station to enable it to carry out local or special experiments. For instance, a tract of over thirty acres in Hardin County was given the University of Illinois in 1917, this making the twenty-sixth tract to be given it for agricultural work. In 1919 a tract of five farms in Maine, aggregating over a thousand acres, was donated by Mr. P. W. Sprague of Boston to the Maine Agricultural and Industrial League, primarily for demonstration purposes. Within the last year two tracts have been conveyed to Cornell University by individual gifts for a fresh-water biological field station and a wild-life preserve for research and study.

Land for the citrus substation at Lake Aldred, Fla., was donated in 1919 by citrus growers of Polk County, together with funds for the erection of a building and the maintenance of the substation. A study by the Florida Station of pineapple diseases was also made possible about the same date by funds placed at its disposal by growers of St. Lucie County.

During the past summer considerable work in tobacco improvement was instituted by the Connecticut State Station. A tract of thirteen acres was acquired from funds accruing under the Lockwood bequest of 1894, and cooperation with the newly organized Connecticut Valley Tobacco Improvement Association has been possible through funds supplied by this association of growers, packers, and dealers supplementing a State appropriation of $10,000.

An interesting experiment which would not have been possible with funds available from other than private sources has recently been begun in Indiana. An exhibit made at the Indiana State Fair and later at the International Live Stock Show at Chicago, showing models of a specific farm in run-down condition and rehabilitated on a scientific plan, attracted the attention of two gentlemen who offered to purchase the farm in question and finance its renovation.

The farm was purchased the past spring, new buildings erected and others repaired, and a definite farm system laid out. The purchase price and improvements will represent a total expenditure of from $100 to $120 an acre. A local committee, consisting of the president and vice-president of the local farm bureau, the county agent, and a merchant, is operating the farm, with the advice of specialists at Purdue University, through a working foreman. Local initiative is thus stimulated and is practically in charge of the enterprise, which, if successful, will benefit not only the community but other sections. Everything will be conducted on a practical basis and strict accounts kept, and incidentally the university and station expect to get some quite accurate data.

The University of Tennessee has been the recipient of two interesting bequests. One was the Strong legacy of 1915, compromised after considerable litigation to include $65,000 and certain real estate, about $35,000 becoming available for the College of Agriculture. The other was a gift of $25,000 from Miss Mary Boyce Temple in 1919 for the carrying on of certain agricultural tests by the division of agricultural extension.

An income of about $2,000 a year became available to the University of California in 1920 through the will of Mr. James Horgan for the promotion and development of agriculture, especially at the University Farm at Davis. In 1915 the Washington Station was given $1,000 by Mr. William Anderson for studies of diseases of domestic animals.

The Biggs Cereal Station was organized by the Sacramento Valley Grain Association, Inc., of California on a subscription basis to develop new and more profitable crops for the valley, and a tract of about fifty acres of land and buildings costing $6,000 were provided. In 1912 this plant was turned over to the Bureau of Plant Industry, U. S. Department of Agriculture, for operation as a field station in connection with its cereal investigations and devoted quite largely to rice experiments. Somewhat similarly, the plant of the Virginia Truck Station at Norfolk was donated in 1917 to the State by the local truckers' association which had organized it. A fig experiment station under the auspices of the J. C. Forkner Fig Gardens began operation near Fresno, Calif., in 1920, about ten acres being available for experimental purposes.

Two noteworthy projects of the past year have been the founding of the Thompson Institution for Plant Research at Yonkers, N. Y., and the American Food Research Institute at Leland Stanford University. For the latter institution, a grant of $700,000 has been made by the Carnegie Corporation of New York for maintenance for the first ten years, and an intensive study of problems connected with the production. distribution, and the consumption of food is contemplated.

Even more recent has been the establishment of the Marble Laboratory, Inc., at Canton, Pa., from funds provided by Mr. L. M. Marble for study of problems connected with fruit storage. Equipment has been provided for ventilation and humidity studies, including cold storage rooms, and a sixty-acre apple orchard is available to supply material.

Despite efforts to obtain as complete a record as possible, numerous contributions have doubtless been omitted from the foregoing summary. Opportunity has recently been afforded, however, to obtain another view of the situation as regards research through a compilation issued by the National Research Council. This compilation deals with funds available in 1920 in the United States for the encouragement of scientific research, and is classified both by institutions and subject matter.

It is interesting and at first sight somewhat disheartening to note that of nearly a thousand separate funds itemized, the number classified under agriculture consists of only two funds for institutional research and ten series of fellowships, scholarships, research assistants, and similar positions. More extended examination of the system of classification, however, reveals the inclusion of numerous other funds of direct agricultural interest under the basic sciences, such as bacteriology, biology, chemistry, ecology, genetics, and veterinary medicine, as well as an even larger number classified as industrial research.

The two funds listed as available under agriculture are the Bradley fund of $20,000 established in 1897 at Harvard University for scientific investigations to increase the knowledge of trees, and the Ring memorial fund of $1,000 at Cornell University for the advancement of horticultural science. The fellowships and scholarships provide for a considerable range of subjects, including inheritance of disease resistance, economic entomology, and forest production at the University of Wisconsin; agricultural history and general agriculture at the Iowa State College; agronomy, animal husbandry, dairy husbandry, poultry husbandry, food economics and nutrition, bacteriology, and botany at the Kansas College; agriculture and botany at the Washington College; agriculture at the Universities of California and Minnesota; and seven industrial phases of agriculture at Cornell University. There is also included a travel fellowship of $1,000, established by the American-Scandinavian Foundation for the purpose of drawing the American and Scandinavian peoples closer in bonds of intellectual friendship.

Of the funds classified under industrial research, mention should be made of $2,200 annually available for investigations at the University of California of citrus fruits from the Citrus Fruit Growers'

Fund; $2,880 for lemon investigations from the Lemon Men's Club Fund; and $2,000 for poultry studies from the Petuluma Poultry Men's Fund. The same university also had available $15,800 and Leland Stanford University $12,600 for investigations of botulism, these funds being provided by olive growers and commercial interests. A considerable range of industrial fellowships and scholarships is also listed, including eleven at Rutgers College on various plant nutrition problems and disinfectants, six at various institutions for studies of the use of gypsum in crop production, one at the University of Hawaii for the study of pineapple problems, and one each at the Kansas College and Leland Stanford University in flour milling problems.

The compilation of the National Research Council also attempted to list the medals and prizes available. None of these were discovered for agricultural research, and of those under other heads only one seems directly applicable. This is the Meyer Memorial Medal for distinctive service in plant introduction, established in 1919 from funds left by the late Frank N. Meyer, agricultural explorer of the U. S. Department of Agriculture for many years.

From a study of the data available, the conclusion appears inevitable that agricultural education and research are still being comparatively overlooked as opportunities for private philanthropy. During the past decade financial assistance for specific problems has been provided in increasing amounts in some States by groups of producers and commercial organizations, but the possibilities in even these directions have by no means been exhausted.

Likewise, the alumni associations of various agricultural colleges have greatly improved in solidarity and effectiveness, and more and more have contributed financially as well as in other ways to the up-building of their respective institutions. The elaborate soldier memorials, quite commonly in the form of student activities' buildings, already completed in Massachusetts and under way in Ontario, Michigan, Iowa, California, and other States, may be cited as concrete illustrations of the growing realization of alumni responsibility, as well as an indication of their disbelief in the fear sometimes expressed that private contributions may merely serve to substitute these funds for public appropriations.

But the aggregate of all such gifts is still small, too small with most institutions to make them appreciable factors in the institution's budget. It is even probable that the total thus contributed for agricultural education and research in this country is considerably less than the amount raised within our borders for the support of agricultural missions abroad, these enterprises now numbering, it is reported, farms at no fewer than 241 mission stations. Quite certainly it is smaller than the private support accorded in Great Britain for agricultural instruction and research, where, however, public aid has been comparatively recent and less exclusively relied upon.

In the field of research, the opportunities seem specially numerous at the present time, whether for large or more modest contributions. Inadequate revenues, both absolutely and relatively, have since the war become more and more a limiting factor in the progress of agricultural research agencies. It may again be pointed out that the world still lacks a large and permanently endowed institution for research in agriculture, analogous to the Rockefeller Institute in the field of medical science, for example, though the usefulness of such an institution was never more apparent. On a smaller scale, the provision of funds for fundamental studies requiring a considerable period for solution would appreciably relieve the pressure on tax-supported institutions for immediately practical results, and correspondingly augment their resources and usefulness.

Doubtless one of the principal reasons for the paucity of private contributions in the past has been the unfamiliarity as to the real needs of educational and research institutions of persons in position to aid. Oftentimes this is a condition which might readily be remedied to some extent by the institutions themselves through greater publicity. Obviously, no campaign of solicitation of the wealthy could properly be undertaken, but there would seem to be ample justification for letting the public know the situation and some of the ways in which private funds applied to agricultural education and research could render effective returns. In this way the cooperation of benevolent persons or organizations with institutions designed for the benefit of the general public might be stimulated.

The recent announcement by the United States Department of Agriculture of the initiation of graduate courses of instruction for its personnel is an important departure which may mean much to those availing themselves of the opportunity. It is at once a recognition of the desirability of systematic study for those specializing closely in their work, and a response to the desire for such instruction by employees whose duties confine them closely to Washington. It is an attempt to utilize available material in stimulating broader training.

For many years the lack of facilities in the District of Columbia for advanced study in agricultural lines has been a serious handicap to the Department's efficiency as a growing scientific institution. Of the hundreds of ambitious young men and women attracted to its ranks by its unique position for service along national lines, far too many have become discouraged in their efforts to broaden or extend their training and have accepted positions elsewhere with greater opportunities for study, while with others the restriction of their individual development has reacted to the disadvantage of the Department as a whole. What has made the situation the more regrettable has been the presence on the Department's own staff of many authorities in various fields of agricultural science competent to offer such instruction, the unusual wealth of original data, the unexcelled library facilities, and other educational assets of great potentiality.

In recent years efforts have been made to utilize some of these advantages, and under Department and bureau auspices lectures by the Department's own staff and visiting scientists have become quite numerous and a source of much inspiration and enlightenment. The almost total lack of suitable quarters for even relatively small groups, however, has been a very definite handicap to gatherings of this sort, and the information obtainable has necessarily been too fragmentary and sporadic to constitute in any sense a substitute for formal graduate instruction. Manifestly it could not be accepted as a basis of credit by educational institutions, a phase in which Department workers have been acutely interested.

In recognition of these things, during the past summer representatives of the various scientific bureaus were designated as a committee under the leadership of Dr. E. D. Ball, then Assistant Secretary of the Department, to consider the problem of arranging, if possible, a program of educational work for the current year. Such a program was eventually formulated and approved by Secretary Wallace for immediate adoption.

This program contemplates an unofficial system of advanced instruction in those scientific and technical subjects relating to the Department's work in which adequate instruction is not otherwise available in Washington. This restriction is intended to prevent duplication of the opportunities already open in some of the sciences and related fields through the various educational institutions of the community, and the courses will thus supplement existing facilities and resources.

The object of the instruction is stated in the prospectus as "to enlarge and improve the service rendered by the Department by affording an opportunity to those who wish to fit themselves for greater usefulness through better training and increased knowledge." For the present, two more or less distinct kinds of work will be offered. The first of these will include lecture and drill courses on certain fundamental subjects in which the personnel of two or more bureaus are interested. The second will comprise intensive graduate training in special topics. Lecture courses are to be held immediately after office hours. In general each course will occupy two hourly periods per week for a year of thirty weeks or a half year of fifteen weeks. The cost of the instruction will be met through very moderate tuition charges, and participation is put on an entirely voluntary basis.

The advanced courses are to be of distinctly university grade and restricted to students of adequate preparation. A system of credits will be put into operation, and it is hoped that arrangements will be completed with educational institutions for their acceptance in degree work, including both undergraduate and postgraduate degrees. If this can be accomplished, one of the principal obstacles to organized instruction in the past will have been eliminated.

For the present, attention is to be concentrated on a comparatively few lines of outstanding interest. The courses already arranged for include advanced work in agricultural economics, biochemistry, mycology, plant physiology, genetics, and the physics of the air. Two statistical courses are also scheduled, one a review course in the underlying principles, development, and application of statistical methods, and the other a detailed presentation of statistical mechanics applied to chemical problems. Most of these courses are regarded as foundations for more specialized work to follow. Ultimately, numerous special graduate courses are contemplated in various lines, embracing work to extend over several years. These courses will be carried on through the immediate supervision of Department specialists, under the general direction of the graduate committee.

Responsibility for the project as a whole will also rest largely with this committee, with Dr. Ball continuing as its head in his new position of Director of Scientific Work. While designed with particular reference to Department employees, it has been a matter of conference with the officers of the Association of Land Grant Colleges, who have expressed interest in it as opening to their students and workers another channel for advanced study.

The beginning of actual instruction was scheduled for October 17, and at the time of writing registration was in full swing with indications of a large enrollment and much interest. As time goes on difficulties of various kinds will doubtless arise, but it would seem that the new enterprise was being launched under auspicious circumstances and with exceptional opportunities for useful service. The modest scale on which it is being started indicates a conservativeness of policy which augurs well for the gradual development of a very valuable agency for graduate instruction in agricultural science.

RECENT WORK IN AGRICULTURAL SCIENCE.

AGRICULTURAL CHEMISTRY—AGROTECHNY.

Chemist's calendar, I, II, W. Roth (*Chemiker-Kalender. Berlin: Julius Springer, 1921, vols. 1, pp. XIX+502, figs. 10; 2, pp. IX–520, pl. 1, figs. 33*).—In the 1921 edition of this well-known annual several of the sections have been rewritten and brought up to date.

Yearbook for agricultural chemistry, edited by T. Dietrich and F. Mach (*Jahresbr. Agr. Chem., 3. ser., 18 (1915), pp. XXXI+504*).—This is the yearbook for 1915 of the series previously noted (E. S. R., 35, p. 311).

Yearbook for agricultural chemistry, edited by F. Mach (*Jahresber. Agr. Chem. 3. ser., 19 (1916), pp. XXXVI+520, p. 1; 20 (1917), pp. XXX+514; 4. ser., 1 (1918), pp. XXX+546*).—These volumes continue the series noted above.

A dictionary of chemical solubilities, inorganic, A. M. Comey and D. A. Hahn (*New York: Macmillan Co., 1921, 2. ed., rev. and enl., pp. XIX+1141*).—In the revision of this very complete dictionary of inorganic chemical solubilities, the first edition of which appeared in 1895, the data have been brought up to January 1, 1916. The arrangement of data on each substance consists of the solubility in water, the specific gravity and boiling point of the aqueous solution, and the solubility in inorganic acids, in alkali and salt solutions, and in organic solvents. Where different results have been obtained by various workers, data from all the original sources are given. An appendix contains formulas and tables for the conversion of the degrees in the various hydrometer scales into specific gravity and a synchronistic table of the more important chemical periodicals from 1800 to 1916.

Technical handbook of oils, fats, and waxes, P. J. Fryer and F. E. Weston (*Cambridge, England: Univ. Press, 1920, vol. 1, 3. ed., pp. XII+280, pls. 42, figs. 33*).—This is the third revision of the volume previously noted (E. S. R., 40, p. 804).

Chemical examination of Aconitum columbianum (*Wyoming Sta. Rpt. 1920, p. 131*).—Preliminary work on the chemical examination of *A. columbianum* by P. T. Miller is briefly reported. The plant has been shown to contain both a crystalline and an amorphous alkaloid, both being found principally in the roots of the plant. A considerable yield of aconitic acid was obtained from all parts of the plant.

[Gossypol in cottonseed meal], W. A. Withers (*North Carolina Sta. Rpt. 1920, pp. 32, 33*).—Further work on the effect of various agents on the gossypol content of cottonseed meal (E. S. R., 43, p. 411) is noted, the results of which suggest the possibility that hydrolysis rather than oxidation is effective in eliminating the gossypol from the meal. The optimum conditions for hydrolysis have not been ascertained.

The effect of alkali on the efficiency of the water-soluble vitamin B, T. B. Osborne and C. S. Leavenworth (*Jour. Biol. Chem., 45 (1921), No. 3, pp. 423–426, figs. 2*).—Attention is called to the conflicting views regarding the stability of vitamin B to alkali, and experiments are reported which confirm the observations of those who have reported the destruction of this vitamin when heated with alkalis.

A vitamin preparation obtained from brewery yeast according to the method of Osborne and Wakeman (E. S. R., 42, p. 314) was treated with sufficient NaOH solution to neutralize the acidity of the preparation and leave an excess equivalent to N/10 alkali. Portions of this solution were allowed to stand at 20° C. for ½ hour, 18 hours, and 90 hours, respectively, and were then made faintly acid to litmus with N/10 HCl. A fourth portion, after standing at 20° for 18 hours, was heated to 90° in a water bath for 1 hour and then slightly acidified. The extracts were all evaporated on starch and made into tablets, each containing 15 mg. of the vitamin extract. These were administered to rats declining on a diet free from vitamin B.

The subsequent growth curves of the animals showed that the efficiency of the vitamin was not appreciably impaired by the ½ or 18-hour treatment with alkali, but that more prolonged treatment impaired and heating quickly destroyed the activity. "It thus appears that in attempting to concentrate, or isolate, the water-soluble vitamin B dilute alkaline solutions can be used without materially affecting its activity, provided a low temperature and a short time of exposure to the alkali are employed."

The significance of the H-ion concentration for the digestion of proteins by pepsin, J. H. NORTHROP (*Jour. Gen. Physiol., 3 (1920), No. 2, pp. 211–227, figs. 4*).—In this paper, which continues the series of studies on pepsin previously noted (E. S. R., 44, p. 110), experiments are reported which show that the rate of digestion and the conductivity of protein solutions are very closely parallel, that when proteins of different isoelectric points are used the range of H-ion concentration in which the enzym is active shifts in the same sense as the conductivity of the protein solution, and that the enzym combines with an insoluble protein only over that range of H-ion concentration in which the enzym is active and the protein ionized. It is pointed out that while these facts are in agreement with the hypothesis that the determining factor in the digestion of proteins by pepsin is the amount of ionized protein present in the solution, this hypothesis "can not be extended directly to enzyms in general, since in many cases the substrate is not known to exist in an ionized condition at all. It is possible, however, that ionization is really present, or that the equilibrium instead of being ionic is between two tautomeric forms of the substrate, only one of which is attacked by the enzym."

Colorimetric determination of H-ion concentration by means of a double-wedge comparator, G. D. and C. W. BARNETT (*Soc. Expt. Biol. and Med. Proc., 18 (1921), No. 4, pp. 127–131*).—The method described by Barnett and Chapman (E. S. R., 39, p. 9) for determining H-ion concentration colorimetrically without the use of buffer solutions has been extended to the group of indicators of Clark and Lubs, the work reported being largely a confirmation of the results of Gillespie (E. S. R., 43, p. 11) which appeared while the present investigation was in progress.

For making the determination reported, a comparator was used which consisted of a long narrow rectangular glass box containing a diagonal glass partition, dividing it into two equal wedge-shaped compartments placed base to apex. With one wedge filled with acid indicator solution and the other with alkaline indicator solution of the same concentration, light transmitted horizontally through the box gives the complete color range of the indicator.

"For calibrating the color scale in terms of pH, buffer solutions of known H-ion concentration and containing the same indicator concentration were placed in a small glass box having the same fluid diameter as the large box.

For any given buffer solution within the range of the indicator an exact color match is obtained. A scale along the lower edge of the comparator is divided into 100 parts and graduated from left to right. If the acid color of the indicator occupies the left end of the comparator, the readings of this scale will thus represent the percentage of alkaline indicator color present in the color blend observed at that point. The colors are best viewed against an oblique plate mirror reflecting the sky."

A table of dissociation constants of the indicators used and the corresponding scale readings is included.

A new nephelometer and the principles of nephelometric measurement, H. Kleinmann (*Kolloid Ztschr., 27 (1920), No. 5, pp. 236–241, figs. 2; abs. in Jour. Soc. Chem. Indus., 40 (1921), No. 3, pp. 101A, 102A*).—The principle of the new type of nephelometer described is the measurement of the height of a Tyndall cone which produces the same intensity of illumination in two liquids, one of which is the standard. Two graduated glass tubes, in each of which is a polished glass cylinder, are placed side by side on a metal foundation in front of two adjustable shutters. The unknown and standard liquids are placed in the tubes, and the width of the shutter openings so regulated that the light passing through them from the Tyndall cones illuminates both with equal intensity.

A short test for easily soluble phosphate in soils, O. M. Shedd (*Soil Sci., 11 (1921), No. 2, pp. 111–122*).—A rapid test which has been devised at the Kentucky Experiment Station for estimating roughly the soluble phosphorus in soils is described, and comparisons are reported of results obtained by this short test with the quantitative results from 5-hour digestion with the same reagents. The technique of the short test is as follows:

Ten gm. of air-dried soil is added to 25 cc. of N/50 HNO_3 and the mixture shaken every minute for 5 minutes. The solution is filtered until clear into a $\frac{5}{8}$ by 6 in. test tube, 1 or 2 cc. of 60 per cent NH_4NO_3 solution and 5 cc. of ordinary molybdate solution as prescribed in the Official method for fertilizers are added, and the contents of the tube are heated to about 60° C., shaken several times, and allowed to stand about 30 minutes at room temperature. The content of soluble phosphorus is estimated as large, moderate, etc., from the amount of precipitate formed, the term moderate indicating that the precipitate after settling occupies an area from 0.5 to about 0.75 cm. in diameter.

The quantitative determination consists in digesting the soil in N/50 HNO_3 in the proportion of 1 gm. of soil to 10 cc. of the acid for 5 hours at room temperature, shaking every 30 minutes. It is then filtered, an aliquot evaporated to dryness, more HNO_3 added to oxidize the organic matter, evaporated again, and the last traces of HNO_3 removed by evaporation with HCl. The residue is dried on a steam bath to dehydrate SiO_2, taken up with HCl and water, and filtered. The phosphorus is precipitated with ammonium molybdate and, after standing over night, filtered and determined volumetrically.

Tables are given of the results obtained in the short test and the quantitative test for soluble phosphorus, and for total phosphorus by the magnesium nitrate method in four groups of soils, classified according to the proportions of soluble and total phosphorus. The conclusions reached by the N/50 HNO_3 digestion and the short method are shown to be in accord with experimental field results as regards the soil need of phosphorus. "The weak acid digestion apparently discriminates between those soils in which the phosphorus exists as calcium phosphate and those where it is combined in other forms, such as iron and aluminum and generally considered as not available."

The separation and detection of arsenate and arsenite, G. W. Sears (*Jour. Amer. Chem. Soc., 43 (1921), No. 3, pp. 466–470*).—A procedure for the separation and detection of arsenate and arsenite is described which is based upon the relative solubility of their silver salts in sodium hydroxid, the arsenate being soluble and the arsenite insoluble in 0.5 to 1.5 N solutions of NaOH. The method is said to be capable of detecting 1 mg. of either ion in the presence of 450 mg. of the other.

The estimation of theobromin in cocoa and its products, R. V. Wadsworth (*Analyst, 46 (1921), No. 539, pp. 32–37*).—The principal methods in use for estimating theobromin in cocoa and its products are reviewed and criticized, and a new method is described which is thought to combine the advantages and overcome the drawbacks of the wet and dry extraction methods.

The technique consists in thoroughly mixing 10 gm. of the substance with from 2 to 3 gm. of freshly calcined magnesia in a small porcelain dish, triturating with 14 cc. of water until every particle of the sample is moistened, and placing the dish on the water bath for half an hour to dry partially. The material is then well mixed and transferred to a 250 cc. flask, 150 cc. of tetrachlorethane is added, and the whole boiled under a reflux condenser for 30 minutes. It is filtered while almost boiling into a second flask, the residue and filter paper transferred to the first flask, and the extraction with tetrachlorethane repeated three times. The combined filtrates are distilled through an air condenser until the volume is reduced to from 3 to 5 cc. The residue is cooled, from 60 to 70 cc. of methyl ether added, and the whole mixed and allowed to stand over night, after which the precipitate is collected on tared filter paper, washed with ether, dried at 100° C., and weighed. To this weight is added 0.004 gm. as a correction for the amount of theobromin dissolved in the ether.

The detection of ricin in feeding stuffs by means of serological methods (precipitation, complement deviation, and conglutination) as well as hemagglutination, W. Pfeiler and F. Engelhardt (*Landw. Jahrb., 53 (1919), No. 2, pp. 561–583*).—Results are reported of a series of studies of the delicacy and specificity of various serological tests for the presence of castor bean meal in feeding stuffs. The antiricin serum was obtained by immunizing rabbits with increasing doses of ricin.

Precipitation tests with this serum gave positive results with 0.001 gm. of ricin and with feeding stuffs containing 5 per cent and in some cases only 1 per cent of castor bean meal. Control tests with abrin and crotin gave negative results, indicating the specificity of the reaction for ricin. Hemagglutination tests were positive in the presence of 0.0005 gm. of ricin, but were not specific as the reaction was also given with bean meal. The complement deviation test gave positive results with ricin 1:200,000, 0.001 gm. of castor beans, or feeding stuffs containing 0.5 per cent of castor bean. The test was strongly specific. The conglutination test gave positive results with ricin 1:200,000, 0.0002 gm. of castor bean, and feeding stuffs containing from 0.5 to 5 per cent of castor bean. This test, however, proved nonspecific, bean meal also giving positive results.

The authors conclude that for forensic purposes the precipitation and deviation tests are the most reliable, and that the precipitation method has the advantage of being simpler of execution.

Volumetric determination of mixtures of sugars, T. von Fellenberg (*Mitt. Lebensmtl. Untersuch. u. Hyg., Schweiz. Gsndhtsamt., 11 (1920), No. 4, pp. 129–153*).—The method described, when used for the determination of a single sugar, is conducted as follows: Twenty cc. of a 5 per cent solution of copper sulphate, 20 cc. of a solution containing 175 gm. of Rochelle salts, 25 gm. of Na_2CO_3, and 15 gm. of NaOH per liter, and 20 cc. of water are heated to boiling in an Erlenmeyer flask. Twenty cc. of the neutral sugar solution is then added, the mixture boiled over a low flame for 5 minutes, and cooled rapidly. The precipitated cuprous oxid is dissolved by shaking with from 20 to 25 cc. of an acidified sodium chlorid solution prepared by mixing 1 liter of saturated salt solution with 250 cc. of 10 per cent HCl. The excess HCl is neutralized by carefully adding solid sodium bicarbonate, after which the reduced copper is determined iodometrically. A blank test should be run with water. Tables are given for glucose, invert sugar, lactose, and maltose in terms of the N/10 iodin solution.

In the presence of two or more sugars the above determination is made after "strong" or "weak" inversion, and finally after direct destruction of the reducing sugars with NaOH. For the so-called weak inversion 50 cc. of the sugar solution is heated with 1 cc. of N HCl for 30 minutes on a boiling water bath, cooled, neutralized with 1 cc. of N NaOH, made up to a volume of 100 cc., and the procedure continued as above. For strong inversion 50 cc. of the solution is heated with 25 cc. of 3 N HCl for 45 minutes on the boiling water bath, cooled, neutralized exactly in the presence of methyl orange with 4 N NaOH, made up to 100 cc., and the procedure continued as above. In the presence of two sugars the method of weak inversion is used if one of the sugars is sucrose, and strong inversion if both are reducing sugars. If three sugars are present both methods of inversion are used, and as a control the direct destruction of the reducing sugars by NaOH. The determinations should be made with solutions of the same concentration of such strength that not more than 60 cc. of iodin solution is required.

The application of the method is illustrated by analyses of several infant foods and malt preparations.

A method for the determination of chlorin in solid tissues, R. D. Bell and E. A. Doisy (*Jour. Biol. Chem., 45 (1921), No. 3, pp. 427–435, figs. 2*).—A method of determining chlorin in small amounts of tissue involving less than 5 mg. of chlorin is described, in which the organic matter is removed by a modification of the wet ashing process of Neumann. The material is ashed with concentrated H_2SO_4 and persulphuric acid, and the gases are absorbed in an alkaline sulphite solution formed by action of SO_2 from the digestion gases on sodium carbonate in the absorption tube. The solutions used for titration are those described by Van Slyke and Donleavy (E. S. R., 40, p. 714), except that the picric acid is omitted from the silver solution.

A special apparatus employing suction rather than the pressure of the boiling digestion mixture to carry the gases through the absorption tubes is described and illustrated. Results are reported of duplicate determinations of sodium chlorid in human rectal muscle in normal and pathological conditions, and of comparative determinations of the sodium chlorid content of blood and plasma by this method and the modification of the original McLean-Van Slyke method by Foster (E. S. R., 37, p. 804).

The determination of chlorids in trichloracetic acid filtrates from whole blood and plasma, M. Smith (*Jour. Biol. Chem., 45 (1921), No. 3, pp. 437–447*).—In this modification of the original McLean-Van Slyke method for determining chlorids in blood, trichloracetic acid is used as the blood protein precipitant. The titration with starch iodid solution is rendered more sensitive by the addition of phosphoric acid to the citrate buffer solution, by the use of soluble starch freshly prepared from cornstarch, and by the addition of a definite excess of KI, the amount of which should be determined for each new buffer solution.

A system of blood analysis.—II, Simplified method for the determination of chlorids in blood or plasma, J. C. Whitehorn (*Jour. Biol. Chem., 45 (1921), No. 3, pp. 449–460*).—This paper describes a method of determining chlorids in blood or blood plasma which is especially adapted to the system of blood analysis of Folin and Wu (E. S. R., 42, p. 712). The procedure, which employs the tungstic acid protein-free filtrate, is based upon the principle of the Volhard method, consisting of the precipitation of silver chlorid from a known amount of silver nitrate and the titration of the excess silver nitrate by thiocyanate, using ferric ammonium alum as an indicator. The technique is described in detail, a similar procedure described by Rieger (E. S. R., 44, p. 506) is discussed and criticized, and the accuracy of the present method is discussed with experimental data indicating a limit of error of less than 1.5 per cent.

The determination of chlorids in blood plasma, J. H. Austin and D. D. Van Slyke (*Jour. Biol. Chem., 45 (1921), No. 3, pp. 461–463*).—As the method for the determination of chlorids in blood plasma involving a single precipitation of proteins and chlorin, described by Van Slyke and Donleavy (E. S. R., 40, p. 714), has been found to give too high results with pathological cases, the authors recommend the preliminary removal of the proteins as in the Austin-Van Slyke method for whole blood before the chlorids are precipitated with standard silver nitrate in all plasmas, both normal and pathological.

A clinical method for the quantitative determination of calcium and magnesium in small amounts of serum or plasma, B. Kramer and F. F. Tisdall (*Bul. Johns Hopkins Hosp., 32 (1921), No. 360, pp. 44–48*).—A rapid method of precipitating calcium and magnesium quantitatively from small amounts of unashed blood serum by a modified McCrudden technique (E. S. R., 23, p. 9) is described, together with the technique for the separation and determination of the calcium and magnesium.

The removal of ammonia from urine preparatory to the determination of urea, G. E. Youngburg (*Jour. Biol. Chem., 45 (1921), No. 3, pp. 391–394*).—The author states that in the Van Slyke and Cullen technique for the determination of urea by urease (E. S. R., 33, p. 116) the ammonia determination can be eliminated by preliminary removal of ammonia by the permutit method of Folin and Bell (E. S. R., 37, p. 311), and that the more satisfactory and less expensive urease solution of Folin and Youngburg (E. S. R., 41, p. 13) may be used instead of the acetone-insoluble preparation of Van Slyke and Cullen. The technique of the revised procedure is described, and data are presented showing the degree of accuracy obtainable.

An improved apparatus for use in Folin and Wu's method for the estimation of urea in blood, T. Watson and H. L. White (*Jour. Biol. Chem., 45 (1921), No. 3, pp. 465, 466, fig. 1*).—The apparatus, which was devised to prevent frothing when distilling over the ammonia in the Folin-Wu method of determining urea in blood, is made from a 25 cc. pipette with a bulb in the center. The pipette is bent so that one end extends vertically into the distilling flask and the other, parallel to the first, into the receiving flask, the part containing the bulb forming an angle of 45° with the tube extending into the distilling flask. This part of the tube has a number of small holes blown in the side and a constriction in the end. The large bubbles of form are broken up in passing through the numerous holes, thus preventing the liquid from being carried over into the receiving flask.

Dehydrating foods, A. L. Andrea (*Boston: Cornhill Co., 1920, pp. [XI]+206, pls. 13*).—This book on dehydration contains, in addition to a brief discussion of the uses of dehydrated products and of large scale methods of dehydration, general and special directions for dehydrating foods in the home and recipes for the use of dehydrated products.

Methods of preparing vegetables for dehydration, P. F. Nichols and C. R. Gross (*Chem. Age [New York], 29 (1921), No. 4, pp. 139–141, figs. 2*).—An investigation, conducted at the Bureau of Chemistry, U. S. Department of Agriculture, on the relative values of different methods of blanching or processing vegetables in preparation for dehydration, is reported briefly. Freshly prepared carrots, potatoes, and cabbage were subjected to treatment with steam, hot water, hot 2 per cent salt solution, and hot 1 per cent sodium bicarbonate solution, and in the case of potatoes hot 0.1 per cent solution of sodium bisulphite or sulphite for 2, 3, and 4-minute periods, after which the products were spread on trays and dried in a commercial drier of the tunnel type.

With carrots more attractive dehydrated products were produced on blanching by immersion, in the order named, in hot 2 per cent salt solution, hot 1 per cent sodium bicarbonate solution, or in hot water than by processing in steam. With potatoes none of the immersion methods produced better products than steam processing, but equally as good ones were obtained by immersion in hot solutions of 0.1 per cent sodium sulphite or bisulphite, and nearly as attractive ones by blanching in hot water and hot 2 per cent salt solution. Cabbage blanched by hot water and hot 2 per cent salt solution was more satisfactory and blanched with 1 per cent sodium bicarbonate solution less satisfactory than blanched with steam.

These results are thought to indicate that dehydrated products equally as attractive as those prepared by steam blanching can be prepared by blanching with immersion. The latter method is also thought to have the advantage over steam immersion of being more easily controlled.

Manufacture of sweet potato flour by the flake process, C. E. MANGELS and S. C. PRESCOTT (*Chem. Age [New York], 29 (1921), No. 4, pp. 132–135, fig. 1*).—An investigation conducted by the Bureau of Chemistry, U. S. Department of Agriculture, of the possibility of converting a surplus of sweet potatoes into sweet potato flour is reported briefly. The flake process successfully used for the preparation of flour from white potatoes proved unsatisfactory on account of low yield and the poor color and texture of the product.

Preparation of sweet potato sirup, H. C. GORE (*Chem. Age [New York], 29 (1921), No. 4, pp. 151–153, figs. 2*).—Detailed directions are given for the preparation of sweet potato sirup as developed at the Bureau of Chemistry, U. S. Department of Agriculture. Although it has been found possible to make the sirup without malt (E. S. R., 44, p. 615), it is stated that the best results are obtained with the use of a small proportion of barley or wheat malt.

Glucose and starch from maize, T. D. HALL and G. M. HAY (*So. African Jour. Indus., 3 (1920), No. 7, pp. 597–605.*—Data are presented on the glucose, starch, and oil yield of three South African varieties of maize, Brazilian flour corn, Hickory King, and Chester County.

The prickly pear (Opuntia).—Possibilities of its utilization, C. F. JURITZ (*So. African Jour. Indus., 3 (1920), Nos. 8, pp. 687–693; 9, pp. 803–814*).—This paper deals with the various industrial possibilities of the prickly pear (Opuntia), including its use as an article of human diet, a potash fertilizer, a fiber for paper making, a dye, a mucilaginous glaze or dressing for textile fabrics, and as a source of sugar, vinegar, industrial alcohol, oxalic acid, and oil. A list of 26 literature references is appended.

Larch (Venice) turpentine from western larch (Larix occidentalis), S. A. MAHOOD (*Jour. Forestry, 19 (1921), No. 3, pp. 274–282*).—A physical and chemical examination of the oleoresin from western larch (*L. occidentalis*) is reported. The oleoresin, which has the consistency of honey, is amber in color, has a slightly bitter taste and agreeable odor, and was found to contain approximately 16 per cent of a volatile oil consisting chiefly of α-pinene together with smaller amounts of β-pinene and α-limonene. The nonvolatile portion consisted of a resin possessing acid properties but yielding no crystalline product. The principal constants of the oil were acid number 90.2, saponification number 97.6, ester number 6.4, and specific gravity 1.0054. It is pointed out that while the acid value is high and the ester value low as compared with the commercial standards for Venice turpentine, the values more nearly approach those of the oil from *L. decidua* than do the results obtained by Schorger on Douglas fir turpentine (E. S. R., 37, p. 411).

"Two properties make Venice turpentine of value for particular purposes: It does not readily become hard on exposure; and, after standing, crystals do not form in it. The oleoresin from western larch possesses these properties, and tests made by a commercial firm indicate that western larch turpentine is a satisfactory material for all those industrial purposes for which Venice turpentine is ordinarily used."

METEOROLOGY.

Meteorology and agriculture, E. Gold (*Scot. Jour. Agr., 4 (1921), No. 3, pp. 252–258, fig. 1*).—This article briefly explains the making and use of the weather forecasts issued by the British Meteorological Office.

Reference is made to the studies of Shaw and Hooker on the relation of autumn rainfall on the succeeding season's crops. These studies showed that "broadly speaking, a dry autumn favors the cereal and bean crops of the succeeding year, and mild weather in January and February has the same tendency though in a less marked degree. Rain in April and May is favorable to oats and hay, whereas it is of practically no importance to barley and wheat. All cereals benefit by cool weather in May, June, and July. These results refer to the east of England, and more extended investigations in different parts of the world, notably in Sweden, India, and America, indicate that for each crop there is a 'best' average weather. If the rainfall or temperature of a district is normally above this best average, then the crop benefits by a rainfall or temperature below the normal and vice versa. Ultimately we may hope to arrive at a selection of crops which are the most appropriate for the weather of a district because in that way the earth will yield on the average the best return that is possible."

Underground water and meteorological factors, P. Ototzky (*Quart. Jour. Roy. Met. Soc. [London], 47 (1921), No. 197, pp. 47–54; abs. in Sci. Abs., Sect. A—Phys., 24 (1921), No. 282, pp. 400, 401*).—This is a summary of the author's extensive researches both in the laboratory and under natural conditions.

"The outstanding conclusion is that the variations in the level of the water in a well can not be identified with those of the underground water-level, but that the régime differs. A well acts as a manometer; for example, the immediate rise in the well level in response to precipitation is due to an increase in the hydrostatic pressure of underground gases caused mainly by the direct weight of precipitated water and transmitted by the underground water, of which the level is somewhat depressed. The investigation embraces the effect of air and soil temperature, barometric pressure, thawing of snow cover, and precipitation on underground and well water-level. It is part of a more extensive inquiry in which factors other than meteorological are considered, e. g., influence of forests, vegetable transpiration, geological factors, etc."

Influence of the relief and the heating of the soil on surface winds, O. Mengel (*Compt. Rend. Acad. Sci. [Paris], 172 (1921), No. 23, pp. 1432–1434; abs. in Rev. Sci. [Paris], 59 (1921), No. 12, p. 346*).—From a study of winds at three stations in the eastern Pyrenees the author concludes that the surface or geographic winds are the resultant of two components. One of these is dependent upon the relative position of the areas of high and low pressure, which he designates barometric wind, and the other intimately related to the topography, which is designated topographic wind.

Cloud systems, P. SCHEREESCHEWSKY (*Compt. Rend. Acad. Sci. [Paris], 172 (1921), No. 23, pp. 1429–1431; abs. in Rev. Sci. [Paris], 59 (1921), No. 12, p. 346*).—From simultaneous observations at all the European stations the author concludes that there is a small number of cloud systems which he designates as mobile, fixed, and transition. In the intervals between these systems the sky is either clear or traversed by cirrus or cumulus clouds characteristic of fine weather.

Climatological data for the United States by sections (*U. S. Dept. Agr., Weather Bur. Climat. Data, 8 (1921), Nos. 1, pp. [192], pls. 3, fig. 1; 2, pp. [194], pls. 3, fig. 1*).—These volumes contain brief summaries and detailed tabular statements of climatological data for each State for January and February, 1921, respectively.

Meteorological observations [at the University of Maine, Orono], J. S. STEVENS (*Maine Sta. Bul. 295 (1920), pp. 224, 225*).—A tabular summary is given of monthly and annual temperature, precipitation, cloudiness, and wind during 1920. The mean temperature for the year was 41.88° F., as compared with 43.11° for 52 years; the precipitation was 40.51 in., as compared with a 52-year mean of 39.73 in. The snowfall was 142.75 in., the number of clear days, 176.

Meteorological summary, 1919 (*Oklahoma Sta. Rpt. 1920, p. 56*).—Monthly and annual means of temperature, precipitation, cloudiness, and wind at the station are given in a table. The mean annual temperature was 59.36° F.; the highest 103°, August 6; the lowest −2°, January 3. The annual precipitation was 33.2 in.

Meteorological report for 1919, F. E. HEPNER (*Wyoming Sta. Rpt. 1920, pp. 141–143*).—Observations at Laramie, Wyo., on pressure, temperature, precipitation, humidity, wind, and cloudiness are summarized for each month of 1919.

"The year was abnormally dry and warm. The total precipitation, 8.82 in., nearly one-half of which occurred after the growing season, was the lowest in 18 years. . . . This scarcity of water was the cause of a complete failure of most dry farm crops, and a greatly decreased yield of irrigated crops. Coupled with this dry condition, and helping to accentuate the ill effects resulting therefrom, was a temperature averaging considerably above normal all during the growing season. . . . A killing frost occurred on September 22. Most crops not yet harvested were mature enough to escape injury, so practically no damage occurred."

SOILS—FERTILIZERS.

The physical investigation of soil, B. A. KEEN (*Sci. Prog. [London], 15 (1921), No. 60, pp. 574–589*).—In a contribution from the Rothamsted Experimental Station, soil physics is discussed in four broad sections, namely, the dimensions of the individual soil particles and the manner of their arrangement, soil moisture, soil temperature, and soil atmosphere.

Cause of the yield-increasing influence of the addition of clay to sand soil, O. LEMMERMANN, A. EINECKE and H. WIESMANN (*Landw. Jahrb., 50 (1917), No. 4, pp. 649–677, pls. 3*).—Physical and chemical studies and vegetation experiments are reported, leading to the conclusion that the favorable influence of adding clay to sand is not due to plant stimulation or improvement in moisture conditions, but more probably to the ability of the clay to remove unfavorable properties of the nutritive solution.

Soil survey of the Grass Valley area, Calif., E. B. WATSON and J. B. HAMMON (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1918, pp. 40, pls. 3, fig. 1, map 1*).—This survey, made in cooperation with the California Experiment Station, deals with the soils of an area of 280,960 acres lying mainly in Nevada County in north-central California, and which is situated in the foothill belt of the western slope of the Sierra Nevada Mountains. The topography is rolling, hilly, and steep, and the ruggedness increases from the western part toward the eastern boundary. The area is drained by the Yuba and Bear Rivers.

The soils of the area are almost exclusively of residual origin. Including rough broken and stony land, placer diggings, and riverwash, 12 soil types of 7 series are mapped, of which the Aiken stony clay loam covers 44.6 per cent of the area.

Soil survey of Iowa.—Reports 4–12, W. H. STEVENSON, P. E. BROWN, ET AL. (*Iowa Sta. Soil Survey Rpts. 4 (1918), pp. 48, pls. 2, figs. 11; 5 (1918), pp. 48, pl. 1, figs. 11; 6 (1918), pp. 48, pls. 2, figs. 16; 7 (1918), pp. 52, pl. 1, figs. 18; 8 (1918), pp. 64, pls. 2, figs. 23; 9 (1919), pp. 56, pl. 1, figs. 17; 10 (1919), pp. 48, pl. 1, figs. 17; 11 (1919), pp. 44, pl. 1, figs. 15; 12 (1919), pp. 54, pl. 1, figs. 11*).—These reports present analyses and greenhouse and field experiments to determine the composition, fertilizer requirements, and crop adaptations of the different soil types of the respective counties.

No. 4, Webster County.—This survey deals with the soils of an area of 456,960 acres in north-central Iowa lying entirely within the Wisconsin drift soil area. The southern part of the county is level, and in the northwestern part there are numerous hills and ridges. Drainage is considered to be essential for many of the soils.

The soils are grouped as drift, terrace, and swamp, of which the drift soils cover 94.4 per cent of the area. Including peat and muck, 12 soil types of 6 series are mapped, of which the Webster loam, the Carrington loam, and Webster clay loam cover 46.6, 23, and 22.1 per cent of the area, respectively.

The studies of the individual soil types indicate that drainage is one of the chief requirements for successful crop production. The soils are not generally deficient in lime and, while the content of organic matter varies widely, the soils as a whole are not noticeably deficient in that material. There were no profitable returns from the use of phosphatic and potassic fertilizers.

No. 5, Lee County.—This survey deals with the soils of an area of 327,040 acres in extreme southeastern Iowa lying partly within the Mississippi loess soil area and partly within the southern Iowa loess soil area. The topography is that of a broad upland plain, the surface of which is for the most part slightly undulating to rolling. Drainage is said to be on the whole very satisfactory.

Loess soils cover 79.8 per cent of the area. Twenty soil types of 9 series are mapped, of which the Grundy silt loam, Lindley loam, Putnam silt loam, and Memphis silt loam cover 27.5, 23.7, 11.4, and 10 per cent of the area, respectively.

The soils are generally acid in reaction and require applications of lime. Organic matter is present in considerable amounts, but applications of farm manure have proved profitable. Phosphorus fertilization has not always proved profitable. It is stated that complete commercial fertilizers are probably not generally needed in the soils of the county.

No. 6, Sioux County.—This survey deals with the soils of an area of 489,600 acres in northwestern Iowa lying entirely within the Missouri loess soil area. The topography varies from undulating to sharply rolling. The county is said to be thoroughly drained.

Loess soils cover 80.8 per cent of the area. Including riverwash and rough broken land, 12 soil types of 6 series are mapped, of which the Marshall silt loam covers 80.8 per cent of the area.

The soils are rarely acid, but many areas in the county respond profitably to applications of manure owing to the low organic matter content. Phosphorus fertilization has so far not proved profitable.

No. 7, Van Buren County.—This survey deals with the soils of an area of 308,480 acres in southeastern Iowa lying entirely within the southern Iowa loess soil area. The county is roughly divided into two triangular areas by the Des Moines River which cuts the county diagonally from northwest to southeast. In the northeastern part the topography is rough and broken, and the southwestern part is cut by narrow valleys. The drainage of the county is said to be as a whole fairly good.

Loess soils cover 81.6 per cent of the area. Fifteen soil types of 9 series are mapped, of which the Clinton and Grundy silt loams cover 42.4 and 36.7 per cent of the area, respectively.

Many of the soils of the area are acid and need lime and are deficient in organic matter. The use of phosphorus fertilizers may be profitable now, and it is considered certain that they will be needed in the future. Complete commercial fertilizers are not recommended as profitable.

No. 8, Clinton County.—This survey deals with the soils of an area of 442,240 acres in central-eastern Iowa. The surface of the county is divided roughly into three areas of distinctly different physiography and topography. The Kansan drift plain, with its loess covering, is the most elevated and forms a gentle slope. The Iowan drift plain is generally smooth to almost level. The bottom lands form the third physiographic division. In general, drainage is well established.

Loess soils cover 52.5 per cent of the area. Including muck and riverwash, 27 soil types of 11 series are mapped, of which the Clinton, Muscatine, and Carrington silt loams cover 29.2, 22.2, and 17.1 per cent of the area, respectively.

Many of the soils are deficient in organic matter, and large crop increases are obtained from applications of farm manure. Phosphorus, while deficient in these soils, has not yet given profitable returns. Practically all the soils of the county are acid in reaction and therefore in need of lime.

Information on the prevention of erosion is also included.

No. 9, Scott County.—This survey deals with the soils of an area of 267,486 acres in central-eastern Iowa lying partly within the Mississippi loess soil area and partly within the Iowan drift area. The soils are partly loessial and partly glacial in origin, and topographic conditions are influenced considerably by the origin of the soils. Drainage is well established with a few exceptions.

Loess soils cover 70.3 per cent of the area. Including muck, 26 soil types of 12 series are mapped, of which the Muscatine, Clinton, and Wabash silt loams cover 52.1, 15.1, and 14.4 per cent of the area, respectively.

The studies showed that the soils are generally acid in reaction and in need of lime. The greenhouse experiments especially indicated the value of farm manure in these soils. The phosphorus content of these soils is deficient, and the greenhouse experiments showed that phosphorus fertilizers may prove profitable in the field. For general farm crops it is stated that the needs of the soils for permanent fertility are supplied by the use of manure, lime, and phosphorus.

No. 10, Ringgold County.—This survey deals with the soils of an area of 345,600 acres in southwestern Iowa lying within the southern Iowa loess soil area. The topography of the upland plain of the county is generally undulating and gently rolling to rolling. Only a very small area of upland is poorly drained, and there is not one square mile of land in the county without a drainage outlet.

Drift soils cover nearly half of the area. Eleven soil types of 7 series are mapped, of which the Shelby loam, Grundy silt loam, and Wabash silt loam cover 49.3, 33.2, and 14.4 per cent of the area, respectively. The soils are said to be quite generally acid and in need of lime, and it is recommended that manure be used in liberal amounts to increase the organic matter, which is deficient in some of the soils. The opinion is also expressed that phosphorus fertilizers may prove of value in some cases.

No. 11, Mitchell County.—This survey deals with the soils of an area of 298,880 acres in central northern Iowa lying entirely within the Iowan drift soil area. The surface of the county is in general a gently undulating plain. The natural drainage as a whole is quite adequate.

Drift soils cover 86.9 per cent of the area. Including meadow and muck, 16 soil types of 11 series are mapped, of which the Carrington silt loam covers 74.4 per cent of the area, and is considered the most important soil type.

The soils were found to be quite generally acid, requiring applications of lime. Many of the soils are deficient in organic matter, and the application of farm manure or green manure is recommended. The soils are also deficient in phosphorus, and the greenhouse experiments indicate that the use of phosphorus fertilizers in the field may be profitable. Complete commercial fertilizers are not recommended for general use in the county.

No. 12, Clay County.—This survey deals with the soils of an area of 360,320 acres in northwestern Iowa lying entirely within the Wisconsin drift soil area. The surface of the county is in general nearly flat or gently undulating. It is stated that while much of the upland in the county has been well drained naturally or by the use of tile, there are still some areas where drainage would be of value.

Drift soils cover 73.4 per cent of the area. Including muck and peat, 15 soil types of 7 series are mapped, of which the Carrington loam, the Webster silty clay loam, the Carrington silt loam, and the Lamoure silty clay loam cover 31.3, 20.2, 15, and 11.9 per cent of the area, respectively.

The studies show that some of the soils are of acid reaction and require lime. The supply of organic matter is sufficient in most cases, although many of the types have been found to respond profitably to applications of farm manure. The phosphorus supply is deficient in practically all of the upland soils of the county.

Soil survey of Newberry County, S. C., W. J. LATIMER ET AL. (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1918, pp. 46, fig. 1, map 1*).—This survey deals with the soils of an area of 384,640 acres in northwestern South Carolina, which is situated near the eastern edge of the Piedmont Plateau. The county is well drained and topographically represents a well developed system of low rolling ridges with a narrow broken border along the streams.

The soils are of residual, old alluvial, and recent alluvial origin. Including meadow and rough stony land, 16 soil types of 10 series are mapped, of which the Cecil sandy clay loam, Cecil sandy loam, Appling sandy loam, and Wilkes sandy loam cover 42.2, 12.2, 10.9, and 10.2 per cent of the area, respectively.

Soil survey of Outagamie County, Wis., W. J. GEIB ET AL. (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1918, pp. 42, fig. 1, map 1*).—This survey, made in cooperation with the Wisconsin Geological and Natural History Survey and the University of Wisconsin, deals with the soils of an area of 413,440 acres in east-central Wisconsin, which has topographic features characteristic of a glacial region. The eastern, central, and southern parts, comprising about two-thirds of the total area, have a surface covering of glacial drift and are undulating to rolling. The natural drainage of this region is imperfect. The topography of the northwestern part of the county for the most part ranges from almost level to gently undulating. Large areas of poorly drained land, consisting mainly of peat marshes, occur within this level region.

The soils of the county are of glacial, lacustrine, and alluvial origin. Including peat, 25 soil types of 10 series are mapped, of which the Kewaunee loam, peat, and Kewaunee fine sandy loam cover 15.2, 14.5, and 12.1 per cent of the area, respectively.

Influence of partial sterilization on the composition of the bacterial flora of soil, G. Truffaut and H. Bezssonoff (*Compt. Rend. Acad. Sci.* [*Paris*], *170* (*1920*), *No. 21, pp. 1278, 1279*).—Treatment of the soil with calcium sulphid, orthodichlorocresol, and metadichlorocresol reduced the bacterial content from 75 to 80 per cent within 12 hours. After 8 days the bacterial content increased to from 6 to 8 times that in untreated soil, but decreased again after 12 days, gradually returning to somewhere near normal but never to the original content. This varied somewhat with the method of experiment.

The results of these experiments are also taken to indicate that anaerobic bacteria compose the greater part of the bacterial content of soil which develops after partial sterilization. Nitrifying bacteria appeared to be generally destroyed. A further support of the theory of the predominance of anaerobic bacteria is the fact that *Bacillus butyricus* made up 45 per cent of the flora of treated soils and only from 5 to 10 per cent of that of untreated soils.

Comparative study on the microflora and the nitrogen content of soils partially sterilized by calcium sulphid, G. Truffaut and N. Bezssonoff (*Compt. Rend. Acad. Sci.* [*Paris*], *171* (*1920*), *No. 4, pp. 268–271*).—Three series of experiments are reported which showed that when a strong treatment of a mixture of sulphids and aromatic carbon compounds is given soils in porous pots, oxidation being constant, the aerobic conditions produced favor the loss of ammoniacal nitrogen and are unfavorable to the development of anaerobic bacteria such as *Bacillus butyricus.*

If under the same conditions the soils are cropped, the nitrogen losses are smaller. The use of a maximum treatment of 150 kg. per hectare (133.5 lbs. per acre) of calcium sulphid on cropped soils, in spite of the strong use of nitrogen by crops, prevented the soils from becoming deficient in this element.

The improvement of peaty soils, E. J. Russell (*Jour. Min. Agr.* [*London*], *27* (*1921*), *No. 12, pp. 1104–1113*).—Considerable data on European practice in the treatment of peaty soils are summarized.

The three types of peat found in England are the fen soils, the low-lying peat soils, and the high-lying peat soils. The fen soils are distinguished by the fact that they are not strongly acid and often not acid at all. Drainage is their chief requisite. They are benefited by additions of clay, but not of sand, and do not as a rule respond to lime. The most striking effects are produced by super-phosphate, but not by basic slag.

The low-lying peats require drainage as a first treatment and in addition large dressings of lime, as they are strongly acid. Two general methods of treatment are in use. In the first the land is drained, ameliorating substances are added, and the peat is cultivated as if it were normal soil. In the second method the peat is removed and sold and the under-lying formation is drained, treated, and cultivated. The second method is more popular in England because of the high market value of peat.

The high-lying peats are considered to be the most difficult to improve because the high rainfall intensifies their naturally wet character and the coldness makes agriculture very difficult. These peats are strongly acid. Field experiments with these soils demonstrated their great need for lime.

Effect of lime and organic matter on impervious Kirkland upland soil, M. A. Beeson (*Oklahoma Sta. Rpt. 1920, p. 17*).—Studies of the moisture content and of ammonification and nitrification in this soil showed that limestone, and particularly limestone and manure, stimulated the action of ammonifying organisms and greatly increased the development of the nitrifying organisms. Determinations of total carbon indicated that some of the organic matter had penetrated as far as the second foot of the soil. Practically all of the carbon was found to be organic carbon. The greatest moisture content was found in soils treated with manure.

Soil fertility studies, C. B. WILLIAMS (*North Carolina Sta. Rpt. 1920, pp. 15–22*).—Results of soil fertility studies at the different station farms in North Carolina are summarized.

At the Buncombe farm it has been found in the main fertilizer experiments that phosphoric acid, nitrogen, and lime are the controlling constituents for better crop yields on both the upland and bottom soils of the mountain section. Acid phosphate has been found to be a better carrier of phosphoric acid than raw rock phosphate and soft rock phosphate.

The use of all fertilizer mixtures tried has failed to pay at the Washington farm. Applications of lime usually assure good crop yields, and the use of 2 tons is better than 1 ton. Marl has been found to be a poorer carrier of lime than limestone or burnt lime, and burnt lime is no better than raw ground limestone.

At the Pender farm the controlling constituents for better crop yields are, in their order, nitrogen and phosphoric acid.

At the Edgecombe farm it has been found that the ordinary fertilizer formulas in use should have more nitrogen and potash. Sodium nitrate and ammonium sulphate have been found to be two of the best carriers of nitrogen for corn and cotton.

Phosphoric acid and nitrogen are the most important factors for better crop yields at the Iredell farm.

At the Central farm organic matter is the most important consideration. The use of basic slag and crimson clover is said to be suitable to keep up the yields of cotton. Phospho-germ has given poor results with rye.

Solving soil problems, H. L. RUSSELL (*Wisconsin Sta. Bul. 332 (1921), pp. 31–35, figs. 3*).—The results of 16 years' fertilizer experiments by F. L. Musbach on Colby soils are briefly summarized, showing that the addition of phosphate to stable manure has been advantageous and that better results have been obtained with acid phosphate than with rock phosphate. The use of gypsum and potash did not pay, but lime increased the yield of every crop to which it was applied.

Experiments on the tile drainage of Colby soils showed that the spacing of tile lines 3 rods apart gave much better crops than spacing 4 rods apart. When the tile were spaced 3 rods apart corn was increased in yield 12 per cent, corn stover 10 per cent, barley 6 per cent, and potatoes from 5 to 20 per cent, depending upon the distance from the tile.

Tillage experiments on Colby soil showed that deep tilling and subsoiling have given negative results as a general rule.

The nitrification of stable manure nitrogen in cultivated soil, III, C. BARTHEL and N. BENGTSSON (*Meddel. Centralanst. Försöksv. Jordbruksområdet, No. 211 (1920), pp. 18; also in K. Landtbr. Akad. Handl. och Tidskr., 59 (1920), No. 8, pp. 518–533*).—Laboratory studies of the nitrification of ammonium sulphate and stable manure in acid lowland moss soils are reported.

The nitrification of ammonium sulphate proceeded as powerfully in these soils as in neutral clay soils in spite of the high acidity. The available nitrogen in stable manure was nitrified in these soils and also apparently a certain amount of the original nitrogen of the soil itself. This is considered to be due probably to the neutralizing action of the ammonia of the stable manure on the acid soils.

Liming did not increase the nitrification of stable manure nitrogen in these soils, but did increase the nitrification of ammonium sulphate and of the nitrogenous compounds contained in the soils. Ammonium sulphate was nitrified more readily in these soils than in acid clay soils. As the nitrification of ammonium sulphate proceeded, the P_H value of these soils was lowered from 5.4 to 4 and then remained constant but, nothwithstanding the high acidity, nitrification proceeded unhindered.

The cause of nitrogen losses from solid and liquid manure and other organic substances, O. Nolte and E. Pommer (*Landw. Vers. Sta., 97 (1921), No. 3-4, pp. 245-260*).—Studies of solid and liquid manure singly and combined under aerobic and anaerobic conditions showed only small nitrogen losses over considerable periods. These are attributed mainly to the evaporation of ammonia, and there is said to be no connection between ammonia and moisture evaporation.

The transformation of potassium ammonium nitrate in soil, N. Kempf (*Landw. Vers. Sta., 97 (1921), No. 3-4, pp. 195-217*).—Studies on the transformation of potassium ammonium nitrate in sandy clay soil containing considerable organic matter are reported. Potassium ammonium nitrate is the product of the mitxure of ammonium nitrate and 40 per cent potash salts, and contains approximately 15 per cent of nitrogen and 25 per cent of the ammonium radical.

In the main experiment air-dry soil was mixed with a solution of potassium ammonium nitrate. This mixture was calculated to simulate an extra heavy fertilization with nitrogen and potash to a depth of about 8 in. After 25 days a determination was made of the water-soluble constituents, including nitric, hydrochloric, sulphuric, and silicic acids and the bases ammonium, potassium, sodium, calcium, and magnesium.

It was found that the monovalent bases ammonium, potassium, and sodium were absorbed by the soil, and that the bivalent bases calcium and magnesium took their place in solution. The nitrates varied in behavior. The chlorids were not absorbed. The silicates and sulphates first increased in solution and then gradually assumed insoluble forms. Of the monovalent bases, sodium was the most quickly absorbed at first, but later appeared to be the least absorbed. The absorption of ammonium and potassium from solution increased slowly until it was double that at the beginning. In time more ammonium was absorbed than potassium and sodium together, although at the beginning the absorption of potassium was greater than that of ammonium. Magnesium was not so active as calcium in base exchange.

The transformation of the potassium ammonium nitrate solution proceeded very rapidly during the first minute of contact with the soil and thereafter became gradually slower. After 19 days approximately one-fourth of the ammonium content and only about one-fifth of the potassium content of the solution had been absorbed by the soil.

A condition of equilibrium was established between the soil and the modified soil solution with reference to the quantities of monovalent and of bivalent bases. It is concluded, therefore, that an exchange of bases according to equivalent weights does not occur. When double the given amount of potassium ammonium nitrate solution was used, no more ammonium nitrogen was absorbed than out of the single amount of solution. Less nitrate nitrogen was absorbed from the single than from the double solution. The absorption of potassium from the double solution was independent of the time factor. This was not the case with the single solution.

Previous experiments on fertilization with raw phosphates, O. Reitmair (*Nachr. Deut. Landw. Gesell. Österr., n. ser., 4 (1920), Nos. 38–39, pp. 200–204; 40–41, pp. 214–219*).—The author summarizes a number of pot and field experiments in some detail, extending as far back as 1899, on the relative values of raw rock phosphate and other more soluble phosphates for different crops. One set especially compared coprolite with such materials as bone meal, Thomas slag, and Peruvian guano, and another compared superphosphate with Algerian phosphate. While the more soluble phosphates in most cases gave larger total increases in crops than the raw phosphates, it is concluded that favorable results can be obtained with raw phosphates on most all soil types.

Attention is drawn to the difficulty of drawing conclusions or of comparing results from such experiments, owing to the wide variations in conditions under which they are conducted.

The influence of lime and magnesia on the growth of plants, T. Pfeiffer, A. Rippel, and C. Pfotenhauer (*Jour. Landw., 68 (1920), No. 1, pp. 5–39*).—Studies are reported the results of which are taken to indicate that there should be a fixed relation between all plant nutrients in soil for economic reasons. On the other hand, it was found that the Loew theory that a variation from a fixed ratio between lime and magnesia injures crop growth is not always correct. Approximately the same crop yields were obtained in four different series of experiments in which the lime-magnesia ratio varied between 9:1 and 1:1. There was practically no variation in the amounts of lime and magnesia assimilated by the plants as indicated by analyses. Oats endured a high excess of lime. Crop yields were decreased when the lime-magnesia ratio was varied from 1:1 to 1:9, which is attributed not to injury by the magnesia but to a deficiency of lime. However, there are indications that there may be a partial substitution of magnesia for lime although the lime is of the greater importance in plant growth.

The content of experimental oats plants in lime and magnesia varied within wide limits and in some cases was very high. The general rule that magnesia predominates in the grain and lime in the straw was seldom confirmed. An increasing assimilation of magnesia was not accompanied by a corresponding increase in assimilation of phosphoric acid.

The content of the oats plants in potash and soda was rather high and did not decrease when the assimilation of lime and magnesia increased.

Influence of the lime-magnesia ratio on the growth of plants, O. Loew (*Jour. Landw., 68 (1920), No. 4, pp. 225–233*).—Referring to the work noted above, the author reviews data to show that although there is some evidence that a lime-magnesia ratio of 1:1 or of 2:1, according to the nature of the soil, is the most favorable for the growth of wheat and oats, pot cultures tend to give misleading results owing to crowding of the plants and consequent interference with root growth.

The influence of variable ratios of lime to magnesia on crop growth, O. Lemmermann and A. Einecke (*Landw. Jahrb., 50 (1917), No. 4, pp. 617–648, pl. 1*).—These studies led to the rather indefinite conclusion that there is probably not only an optimum ratio of lime to magnesia in soil, but that such a ratio also exists between other plant nutrients. Since such relations have not yet been established and methods for determining the relatively in minimum plant nutrient in soil are as yet not exact, it is concluded that the ratios for lime and magnesia established by Loew possess no general importance.

The removal of lime from soil by smoke gases containing sulphur dioxid, P. Rusnov (*Centbl. Gesam. Forstw., 45 (1919), No. 11–12, pp. 283–290*).—The author reviews the work of others bearing on the subject, and briefly reports studies which showed that the degree of injury to vegetation by smoke gases stood in no proportional relation to the lime content of the soil or the removal of lime therefrom. Vegetation was injured almost as badly on soil containing from 0.7 to 1.4 per cent calcium oxid as on soil containing no lime.

On the other hand, the injury by smoke gases was closely related to the content of leaves and needles in sulphuric acid. It is concluded that this is the main source of injury.

Sulphur as a fertilizer for wheat (*Agr. Gaz. N. S. Wales, 31 (1920), No. 7, p. 462*).—A series of tests conducted at the Cowra Experiment Station farm for one year with sulphur as a fertilizer for wheat showed a net financial loss in all cases, although slight crop increases were noted in some cases. Sulphur added with superphosphate seemed to nullify the beneficial effects of the latter.

Snow as a fertilizer, M. P. JACQUES (*Sci. Amer. Mo., 3 (1921), No. 4, p. 315, fig. 1*).—Data from French experiments are reported indicating the effectiveness of the snow screen as a protection against frost, and showing that over a 14-year period the soil was enriched by a total amount of nitrogen equal to 14.86 kg. per year per hectare (13.2 lbs. per acre).

Boron in relation to the fertilizer industry, J. E. BRECKENRIDGE (*Jour. Indus. and Engin. Chem., 13 (1921), No. 4, pp. 324, 325*).—Greenhouse experiments with potatoes, beans, and corn to determine the influence of boron in a 4:8:4 fertilizer, made in the laboratory and containing 0.01 per cent of borax by the quantitative method, are reported.

It was found that certain percentages of borax are detrimental to plant growth, but under favorable conditions such as optimum moisture, good drainage, etc., rapid recovery was noticeable. Corn and beans showed borax poisoning with 6 lbs. of borax per acre, and 10 lbs. per acre showed decidedly harmful results. Potatoes were not harmed but rather stimulated when 4 and even 6 lbs. of borax were used, while 8 and 10 lbs. seemed to cause less root formation at the seed and more surface roots. With optimum moisture, plants seemed to recover somewhat from the toxic effect of borax when used at the rate of 6 lbs. per acre, but in short seasons the recovery would be too late for good crop results. The opinion is expressed that the prevention of seed roots by applications of more than 6 lbs. of borax per acre would result in stunted growth and death of the plants in a dry season.

In a brief study of methods for determining boron in fertilizers the conclusion was reached that the method of Ross and Deemer (E. S. R., 43, p. 312) gives accurate results when carefully carried out, but that time may be saved by using the Jones and Anderson modification (E. S. R., 43, p. 613).

AGRICULTURAL BOTANY.

Textbook of pastoral and agricultural botany, J. W. HARSHBERGER (*Philadelphia: P. Blakiston's Son & Co., 1920, pp. XIII+294, figs. 120*).—This is intended to furnish information, including bibliographies, regarding the injurious and useful plants of America, particular attention having been given to the flowering forms. The book epitomizes laboratory and research work as given to veterinary students at the University of Pennsylvania.

Fundamentals of botany, C. S. GAGER (*Philadelphia: P. Blakiston's Son & Co., 1916, pp. XIX+640, figs. 438*).—Of the three main parts of this introductory course in botany, the first (chapters 1–3) deals with fundamental concepts, the parts of a flowering plant, and the cell; the second (chapters 4–11) with the vegetative functions of plants; the third (chapters 12–38) with structures and life histories.

Heredity and evolution in plants, C. S. GAGER (*Philadelphia: P. Blakiston's Son & Co., 1920, pp. XIII+265, figs. 114; rev. in Nature [London], 106 (1921),* *No. 2675, p. 723).*—This little book, intended originally to reprint only chapters 31 to 38 of the above course in botany, includes, as completed, considerable new matter, the older material having undergone certain modifications.

Dictionary of botanical equivalents, E. ARTSCHWAGER and E. M. SMILEY (*Baltimore: Williams & Wilkins Co., 1921, pp. 137*).—A dictionary of technical French and German words and phrases and their English equivalents, compiled for the benefit of readers of foreign botanical literature and containing many terms not occurring in the usual dictionary.

The generic names of bacteria, E. M. A. ENLOWS (*Pub. Health Serv. U. S., Hyg. Lab. Bul. 121 (1920), pp. 115*).—The proposed generic names of bacteria are arranged alphabetically, each with the author and year of erection, reference, and characterization or description of the type species. A list of the species is appended.

New Japanese fungi, notes and translations, VIII, T. TANAKA (*Mycologia, 12 (1920), No. 1, pp. 25–32*).—New fungi as here listed include both saprophytes and parasites, some of which are indicated as species recently described elsewhere.

Questions regarding Cucurbita, J. P. LOTSY (*Genetica [The Hague], 1 (1919), No. 6, pp. 497–531; 2 (1920), No. 1, pp. 1–21, pl. 1, figs. 9*).—Several very different constant forms could be distinguished within the species *C. maxima*, also within *C. pepo*. Varieties of the same species cross easily, giving fertile segregated hybrids, though as yet crosses between varieties of different species have given no results in these experiments. Neither apogamy nor parthenogenesis was observed.

Heredity studies with beans.—III, Albinism, K. TJEBBES and H. N. KOOIMAN (*Genetica [The Hague], 1 (1919), No. 6, pp. 532–538, p. 1, figs. 3*).—In continuation of work previously noted (E. S. R., 43, p. 818), it is stated that a strain of dwarf beans having pale yellow seeds was cultivated for several years. This strain habitually threw a considerable percentage of albino seedlings, all of which died soon after sprouting. Seeds of three of the surviving normal green plants of this strain were gathered separately in 1916 and planted in 1917 and 1918, two of the lots giving normal seedlings only. The third gave green and white plants showing simple Mendelian segregation with green leaf color as a complete dominant. This work is to be continued.

Analysis of a spontaneous bean hybrid, M. J. SIRKS (*Genetica [The Hague], 2 (1920), No. 2, pp. 97–114*).—A study of a bean hybrid, carried on since 1917, resulted in the identification of seven factors, which are discussed.

The grand period [in plant growth], H. SIERP (*Biol. Zentbl., 40 (1920), No. 10, pp. 433–457, figs. 12*).—This deals analytically with *Avena sativa* and *Pisum sativum* as regards growth factors, and changes therein and in growth rate.

Studies on the reaction of plant juices, A. R. C. HAAS (*Soil Sci., 9 (1920), No. 5, pp. 341–370, pl. 1, figs. 11*).—The present paper deals with the actual and total acidities and the total alkalinity of the juices of a number of plants of agricultural importance, together with a study of the influence of liming the soil upon these acidities. The actual acidities of the different parts of the plants and their relation to one another are discussed. The effects of age, lack of chlorophyll, and changes in illumination upon the actual and total acidities of plant juices are also considered. The acidities and alkali reserve have been determined for certain conditions of growth. In order to ascertain the actual reaction of minute quantities of plant juices, a hydrogen-electrode vessel has been used that gave excellent results with only three or four drops of liquid. Such reaction appears to be affected by changes in illumination, soil solution, age, and other conditions, indicating that the reaction of plant juices is the resultant of many processes. The results of preliminary experiments bearing upon some of these factors are reported herein.

It appears that during the life cycle of buckwheat plants the juice may undergo a marked change in its actual reaction. Determinations reported with observations to be presented later are said to indicate the existence of a close relation between the actual and the total acidity, and to show that the total acidity tends to fluctuate in the same direction as the actual acidity. Considerable support is found for the suggestion that the main specific harmful influence of soil acidity on certain plants is due to its influence in preventing the plants from securing rapidly enough the bases that are needed to neutralize and precipitate acids within the plant.

Radioactivity of potassium [in relation to plant activity], J. STOKLASA ET AL. (*Biochem. Ztschr., 108 (1920), No. 1-3, pp. 109-184, fig. 1*).—These three contributions deal respectively with the radioactivity of potassium and its significance in cells lacking or containing chlorophyll; the mechanism of the physiological operation of radium emanation and of the radioactivity of potassium on the biochemical changes in relation to the growth processes of plants; and the significance of radioactivity of potassium in photosynthesis.

Water utilization by plants in wind, BERNBECK (*Naturw. Ztschr. Forst u. Landw., 18 (1920), No. 5-6, pp. 121-141*).—This work includes chiefly studies on transpiration and the relation of transpiration and water transfer to hardiness and other characters of the plant which undergo change with age.

On the relations between growth and the environmental conditions of temperature and bright sunshine, W. E. BRENCHLEY (*Ann. Appl. Biol., 6 (1920), No. 4, pp. 211-244, figs. 17*).—Studies continued for 16 months on peas under controlled conditions are said to indicate that growth shows two well-defined periods, namely, that from the seedling stage until the plant regains its initial weight after loss by respiration, and that during which growth is obvious, lasting until desiccation begins. These periods are discussed.

The maximum growth rate is attained soon after the beginning of the second period, and under favorable conditions is maintained for several weeks. The decline is marked by definite periods, the incidence of which varies according to seasonal conditions. Response to environmental conditions under restricted food supply (though decreased) is broadly similar to response when food supply is unrestricted.

In the early stages of growth, nitrate absorption is large in comparison with dry matter production. This ratio is decreased later owing to the accumulation of the products of assimilation.

The development of photosynthetic activity during germination, G. E. BRIGGS (*Roy. Soc. [London], Proc., Ser. B, 91 (1920), No. B 639, pp. 249-268, fig. 1*).—This is the thirteenth section of a series of experimental researches on vegetable assimilation and respiration, the twelfth having been contributed by Smith (E. S. R., 43, p. 132).

Leaf development precedes photosynthetic activity, which lags behind green pigment formation, a young leaf exhibiting little or no photosynthetic activity. This is considered to indicate that photosynthetic acivity requires some factor other than chlorophyll. The potentiality of this factor rapidly increases independently of chlorophyll and of illumination.

Consideration of the results herein presented shows that the activity of the photochemical part of the photosynthetic mechanism in young seedling leaves as compared with that of more mature leaves is in some way limited, but apparently the photochemical part depends for its intensity not only upon chlorophyll but also upon some other factor. This factor increases with age during the early stages of leaf development.

The bearing of these facts is discussed.

[The effects of cold on seed germination], W. KINZEL (*Naturw. Ztschr. Forst u. Landw., 17 (1919), No. 4–5, pp. 139–142*).—This account, concluding studies previously noted (E. S. R., 35, p. 632), details results of observations on plants representing several genera as regards a method of freezing, and the results obtained with seed which formerly showed low germinability.

Cold resistance as an ecological factor in the geographical distribution of cacti, J. C. T. UPHOF (*Jour. Ecology, 8 (1920), No. 1, pp. 41–53, pl. 1, figs. 6*).—This paper gives the results of a study of the various degrees of resistance to cold of different species of cacti growing in the deserts of Arizona.

It appears that the vertical distribution of cacti depends upon the minimum winter temperature. The author attempts to explain the cold resistance of cacti by means of physiological experiments on the behavior of plants during freezing, an important ecological factor, upon which depends entirely the geographical distribution of the different species.

It is stated that species of cacti having relatively thick integuments are more resistant to low temperatures of short duration than those having thinner integuments, as the penetration of low temperatures through a thick integument is slower than through a thinner one. Thin integument may be accidental rather than adaptive. Since the lowest winter temperatures in the desert are often of short duration, a cactus having a thick integument may pass uninjured through temperature low enough to kill the protoplasm. Thick integument protects cactus against sudden and severe temperature changes at any season.

At higher elevations, on northern exposures, and in more northerly regions where severe cold is of longer duration, thick integuments afford no protection to sensitive plants, so that the geographical distribution of the species is confined to situations not subject to persistent cold.

The protoplasm of these plants can withstand without injury a certain low temperature for each species, below which death occurs. The quality of resistance to cold is hereditary. The temperature which damages a plant to any extent will kill that plant if continued or repeated sufficiently, and this point may be regarded as the killing temperature.

An ecological study of the algae of some sandhill lakes, E. N. ANDERSEN and E. R. WALKER (*Trans. Amer. Micros. Soc., 39 (1920), No. 1, pp. 51–85, pls. 10, fig. 1*).—It appears that the occurrence of algae in a given body of water at a given time is due, to a certain extent, to seasonal periodicity, also that the mineral and gas content of water has much to do with its algal flora. Of these factors, alkalinity is thought to be largely the explanation for the wide difference observed in the algal flora of lakes lying close together and nearly uniform as regards other factors.

In a given lake the distribution of species may be explained as due to the only variable factor, namely light intensity.

FIELD CROPS.

[Report of field crops work in Arizona], G. E. THOMPSON, R. S. HAWKINS, and S. P. CLARK (*Arizona Sta. Rpt. 1920, pp. 440–447, figs. 3*).—Varietal and cultural tests of cereals, legumes, grasses, and miscellaneous field crops are described in continuation of those previously noted (E. S. R., 44, p. 523). Kanred showed a decidedly greater rust resistance than any other wheat variety, while Early Baart, Sonora, Macaroni, and Turkey were heavily damaged by a severe rust attack general in the Salt River Valley.

[Report of field crops work in North Carolina, 1919–20], C. B. Williams (*North Carolina Sta. Rpt. 1920, pp. 22–31*).—Experiments with field crops were conducted along the same general lines as noted heretofore (E. S. R., 41, p. 638; 43, p. 434).

In fertilizer trials with tobacco at Reidsville, muriate of potash demonstrated its superiority over sulphate of potash in affording protection against wildfire, produced better and larger growth, and gave immunity from sand drown. At the Granville Farm the variety known as Big Gem, Make All, or Harrison Pride possessed a superior resistance to leaf spot and made a vigorous growth, but lacked the body and general character of Adcock, Gooch, Warne, and the Orinocos. Results of rate of planting and fertilizer trials indicate that with liberal fertilizer applications an increased yield with good quality can be obtained by planting in 4-ft. rows with plants 24 in. apart in the row.

On red clay soil where cotton received nitrogenous fertilizers with a further side dressing of 50 lbs. of nitrate of soda per acre, a plat receiving nitrate of soda at planting averaged 919 lbs. of seed cotton as compared with 767 from the plat receiving dried blood.

The results of fertilizer experiments with wheat on mountain soils recommend for bottom land soils the use of at least 600 lbs. per acre of fertilizer containing 10 per cent available phosphoric acid and from 1 to 2 per cent of nitrogen. On the upland soils a treatment of 600 lbs. per acre of fertilizer containing from 10 to 12 per cent of phosphoric acid and from 2 to 3 per cent of nitrogen is advised. The nitrogen in the fertilizer used may be reduced by plowing in leguminous crops and crop residues grown in rotation with wheat.

In cotton breeding studies, one strain averaged 2,061.8 lbs. of seed cotton per acre while an inferior strain gave only 985.1 lbs. F_1 hybrids of the more distinct pure lines proved earlier, more vigorous, and more productive than either parent. Where cotton plants from North Carolina and Mississippi-grown seed were grown in comparison, the plants from North Carolina seed were earlier, slightly taller, and more productive, reversing previous results. Selections of Mammoth Yellow, Virginia, and Haberlandt soy beans averaged 5.2, 2, and 6.2 bu. per acre, respectively, more than the general crop from which they were selected.

Report of agronomy department, M. A. Beeson (*Oklahoma Sta. Rpt. 1920, pp. 16, 17, 17–22*).—Further progress of experimental work noted previously (E. S. R., 43, p. 32) is reported. The highest yielders in the variety tests included Silvermine, Boone County White, Strawberry, and Bloody Butcher corn; Nicholson Improved, Fulghum, Kherson, and Red Rust Proof oats; Triumph 44 cotton; Wisconsin rye; and Oklahoma Selected barley.

Alfalfa plats, untreated, receiving lime alone, manure alone, and lime and manure, produced acre yields of 1,618, 2,368, 6,785, and 6,783 lbs., respectively. Where peanuts were cultivated similarly until the spikes were setting, those not cultivated late gave the highest hay yield and lowest nut yield; the plat receiving ordinary cultivation when the spikes were setting made the second highest yield of hay and nuts, and the plat bedded and the vines combed out with an ordinary hay rake gave the lowest hay yield and highest nut yield.

In a test of planting kafir and cowpeas in alternate rows, kafir in 42-in. rows without cowpeas gave the highest forage and grain yields. Results of spacing tests with kafir indicated that from 9 to 12 in. between the plants in the rows will give the highest returns.

Sudan grass gave the best results when seeded from the middle to the last of April. Seedings made in rows yielded less than those made broadcast and produced hay inferior in quality owing to the excess amount of soil raked up with the hay from the row. From 19 to 30 lbs. broadcast appeared to give the best yields.

Breeding work conducted with cotton, wheat, barley, grain sorghums, peanuts, Sudan grass, and Bermuda grass is briefly noted.

[Field crops in upper Wisconsin], H. L. RUSSELL (*Wisconsin Sta. Bul. 332 (1921), pp. 11–17, 18, 20–28, 29, 30, figs. 11*).—A popular discussion of practices and varieties found profitable in the production of field crops on cleared land in upper Wisconsin, together with the outstanding results of experiments with cereals, forage, and root crops by E. J. Delwiche and with potatoes by J. G. Milward at the several substations in this part of the State. The experimental work has largely been noted from other sources (E. S. R., 42, p. 433; 45, pp. 131, 226, and 229).

[Report of the] agronomy department, A. F. VASS (*Wyoming Sta. Rpt. 1920, pp. 124, 125*).—Early seeding of small grains gave the best results, confirming work previously noted (E. S. R., 43, p. 134). The leading cereal varieties included Swedish Select, Abundance, Banner, and Golden Rain oats; Red Fife, Defiance, Bluestem, and Marquis wheat; and O. A. C. No. 21, Charlottown, Smyrna, and Hannchen barleys.

Studies of the relation between the development of potato plants and yields seemed to indicate that the larger and more fully developed plants gave the greater yield. The relation was more marked with mature plants than at 50 days after planting. Where whole, one-half, and one-quarter tubers were used as seed, a direct increase in weight of tubers per hill and total weight per acre appeared as the size of the seed portion increased. Very little difference was noted between the stem and eye ends of tubers when used as seed. The average weight of tubers per hill increased directly as the distance apart of hills in the row increased by 6-in. intervals from 6 to 36 in. Although the total acre yield and also the acre yield of marketable tubers was greatest with the close planting, the percentage of marketable tubers was lowest.

[Report of field crops work in Barbados, 1918–1920], J. R. BOVELL (*Barbados Dept. Agr. Rpt. 1918–19, pp. 3–19; 1919–20, pp. 3–6*).—The continuation of experiments with various field crops along the same lines as heretofore (E. S. R., 44, p. 433) is described. Work with sugar cane has been noted from another source (E. S. R., 45, p. 132).

The improvement of grassland (*Min. Agr. and Fisheries [London], Misc. Pub. 24 (1920), pp. 50*).—A general discussion of the improvement of grassland. The various types of grassland are considered and improvement methods outlined, including fertilizing, mechanical treatment, renovating mixtures, altered methods of grazing, substitution of pasture for meadow conditions, weed eradication, and breaking the turf. Notes are also given on seed mixtures, permanent grass, alfalfa, and sainfoin meadows, and treatment of new pastures.

The improvement of grassland; Suggestions for demonstrations and experiments (*Min. Agr. and Fisheries [London], Misc. Pub. 25 (1920), pp. 16*).—Supplementing the above, this pamphlet comprises schemes simple in character, direct and practical in their object, and intended for farmers. Outlines of experimental methods and the fertilizing of meadow hay, rotation hay, and established pasture are included. The experiments devised for agricultural colleges and institutions, which are more complex and require considerable attention and supervision, include the general treatment of grassland, mechanical operations on grassland, renovating mixtures, the permanence of different varieties, and the effect on permanence of different sources of origin, seed mixtures, and harvesting seed.

The irrigation of alfalfa, F. S. HARRIS and D. W. PITTMAN (*Utah Sta. Bul. 180 (1921), pp. 3–30, figs. 8*).—Field and tank experiments on the irrigation of alfalfa are reported, together with a résumé of earlier work on time and rate of irrigation.

In the experiments at the station the yield generally increased as the total amount of water applied increased up to 90 acre-in., the highest amount applied, but the gain in yield from the application of more than 30 acre-in. was too small to pay for the extra labor. Twenty-five in. applied in weekly quantities of 2.5 in. gave better results than 30 in. where 5 in. were applied each alternate week. With an equal amount of water frequent moderate applications gave better yields than fewer heavy ones.

Where no irrigation was applied 55 per cent of the entire yield came from the first cutting and only 14 per cent from the third. Where regular quantities of water were applied each week, from 33 to 37 per cent of the crop came from the first cutting, from 37 to 39 per cent from the second cutting, and from 25 to 30 per cent from the third cutting. Applying the water at various times of the irrigating season changed the relative yields of the different cuttings, but did not affect the total annual yield consistently.

Alfalfa yielded highest when the soil moisture content was kept constantly at 25 per cent, about the optimum for seed germination, and was not allowed to become much drier periodically. The amount of water required to produce a pound of alfalfa increased with an increase of the amount of water applied.

Corn variety experiments [at] Substation No. 3, Angleton, Tex., E. B. REYNOLDS and N. E. WINTERS (*Texas Sta. Bul. 276 (1921), pp. 5–15, figs. 2*).—Results of variety tests of corn conducted at Angleton Substation during the period 1913 to 1920, inclusive, excepting 1915, are reported. Varieties considered best adapted to the section are described briefly, and a list of those included in the annual tests is appended.

The best yielding varieties during the period included Fentress Strawberry, Hastings Prolific, Ferguson Yellow Dent, Thomas and Chisholm, with average acre yields of 33.5, 31.6, 31.5, 31.2, and 29.6 bu., respectively. In a variety-date of planting test, varieties planted about March 1 made better average yields than when planted 2 and 4 weeks later. Surcropper was first with 31.4 bu. per acre, and was followed by Ferguson and Chisholm.

Disking v. plowing corn land for oats, J. F. COX (*Michigan Sta. Quart. Bul., 3 (1921), No. 3, p. 83*).—Oats on corn land spring disked, fall plowed, and spring plowed produced acre yields of 94.5, 99.7, and 98.3 bu. The increase in yield from spring and fall plowing was deemed hardly sufficient to pay for the increased cost of preparing the land as compared to disking in the spring without plowing.

Growing peas for canning trade, H. C. MOORE (*Michigan Sta. Quart. Bul., 3 (1921), No. 3, pp. 106–108, fig. 1*).—Brief cultural directions.

Rejuvenation and improvement of the potato, J. AUMIOT (*Rev. Gén. Bot., 33 (1921), Nos. 387, pp. 183–189; 388, pp. 244–263; abs. in Compt. Rend. Acad. Agr. France, 6 (1920), No. 35, pp. 853–857*).—Rejuvenation and improvement work with the potato by means of bud mutation, hybridization, and seed selection, conducted in France in 1920, is described. From 142 seed balls, 4,033 seedlings were secured. Those surviving attacks of pests were entirely disease resistant and showed high quality. Several hybrids exhibited high resistance to severe attacks of *Phytophthora infestans*. One hybrid, Beurre× Bolivienne, when planted in contact with varieties affected with mosaic and leaf roll showed absolute freedom from these and other diseases. Individual plants of this cross have given yields of 950, 1,600, and 1,800 gm. per hill, respectively. Regarding hybrids, the author concludes as follows:

The vigor of the resultant cross varies with the differences between parents in regard to morphological characters and their nature. The hybrid derives its characteristics from both parents, but the influence of the male parent is dominant. The tubers of any one seedling plant are identical as to shape and as to color of flesh and skin. Seeds from a single seed ball may produce hybrids differing widely in aerial or subterranean organs, productivity, or earliness. The resistance of a hybrid may be much greater than that of the more resistant of the two parents. This applies in like manner to the other characters of the plant, e. g., vigor, hardiness, productivity, and color and quality of flesh, and is considered the fundamental principle of rejuvenation and improvement. The high fertility of the hybrids has made possible the rendering fertile of main crop varieties commonly sterile.

Chemical studies of the grain sorghums, C. T. DOWELL and W. G. FRIEDEMANN (*Oklahoma Sta. Rpt. 1920, pp. 28, 29, 57–64*).—The work reported included analyses of feterita, yellow and white milo, and Black Hull white kafir at three stages of growth; kafir flour and meal, milo flour, and mixed flours; the ash of the whole plant of these varieties in three growth stages, and the ash of the grain, meal, and flour from grain sorghums; and determinations of water-soluble nitrogen in the green plants, of the inorganic and organic phosphorus in the four varieties, of the pentosans in white milo at three stages of growth and in feterita and kafir at maturity, and of sucrose in kafir, darso, and yellow milo stalks.

The percentage of nitrogen in white and yellow milo was found to be much greater than in feterita and kafir at each of the three stages of growth. The analysis of the ash showed that the grain sorghums removed much potassium and phosphorus from the soil. While the percentage of water-soluble nitrogen is very large in the young plant, it decreases very rapidly when the plant nears maturity.

Soy beans, C. F. NOLL and R. D. LEWIS (*Pennsylvania Sta. Bul. 167 (1921), pp. 20, figs. 2*).—The culture and uses of soy beans are briefly outlined and the results of experiments conducted with the crop at the station reported.

The leading varieties in seed production included Ebony, Elton, Manchuria, Merko, Mongol, and Ohio 10,015. The largest yields of field-cured hay were made by Ohio selections, Elton, and Merko. Data on maturity, seed color, and number of seeds per pound are tabulated for the several varieties studied.

Where soy beans replaced oats in a 4-year rotation of corn, oats, wheat, clover and timothy, they produced much protein per acre, and when cut for hay, slightly more net energy. Wheat gave somewhat lower yields after soy beans than after oats due to later seeding, but the yields of other crops were practically the same. Growing soy beans with corn for silage did not give greater yields of total material than corn alone, but the presence of 10 per cent or more soy beans with corn increased the percentage of protein in the silage appreciably. No indications that corn grown with soy beans contained more protein than corn grown alone were found.

Experimentation in the crossing of sugar cane, L. QUAGLINI (*La. Planter, 66 (1921), No. 15, p. 239*).—The methods and results of hybridization work with sugar cane at the Cuban Experiment Station are outlined.

In crossing Natal Uba cane with Demerara 74, it was necessary to use a variety of wire nainsook-covered caps held in place by props. The best type of cap proved to be one with an upper diameter of 45 cm., a lower diameter of 45 cm., and a height 110 cm. On the lower rim of the cap, 40 cm. of loose cloth was tied around the canes, preventing the access of wind-blown pollen. A cane about to bloom was tied to the arrow of a pollinizing cane and the two placed within the lower part of the cap. The end of the cut pollinizing cane was placed in a can containing about 20 liters of water, with the addition of some charcoal and camphor. About 48 good specimens were obtained, and the results were considered satisfactory.

Sugar-cane experiments in the Leeward Islands, 1918–19, A. E. Collens et al. (*West Indies Imp. Dept. Agr., Leeward Isl. Sugar-Cane Expts., 1918–19, pp. 62*).—Variety tests with sugar cane, conducted in Antigua, St. Kitts-Nevis, and Montserrat in continuation of similar work (E. S. R., 42, p. 635), are reported, together with the results of fertilizer experiments in St. Kitts in the season of 1917–18. Data on soils, rainfall, the distinguishing characters of the principal varieties included in the experiments, and the acreage under the different varieties in Antigua and St. Kitts for the crops of 1917 and 1918 are tabulated.

In Antigua, the two leading plant canes were B. 6308, with acre yields of 23.4 tons of cane and 3,840 lbs. of sucrose, and B. 3922, with 18.9 tons of cane and 3,100 lbs. of sucrose. Sealy Seedling, with an average acre yield of 6,180 lbs. of sucrose, was first of 10 varieties grown during the past 18 years. B. 10650, with an average acre yield of 14.3 tons of cane and 2,350 lbs. of sucrose, and A. 319, with 15 tons of cane and 2,010 lbs. of sucrose, were the highest yielders among ratoon canes tested during 1918–19. Of 10 varieties of ratoon canes grown during the past 17 years, Sealy Seedling was first, with an average of 3,510 lbs. of sucrose per acre.

Results of experiments with plant cane for three seasons indicate that in Antigua canes are generally ripe at 15 months of age. The question of maturity is thought due to rainfall, as in wetter climates, such as Trinidad, experimental data indicate that canes ripen in from 18 to 19 months. B. 6450, which ripens in Antigua in from 15 to 15.5 months, is considered very late in Trinidad, where it matures in from 18.5 to 19 months.

The leading plant canes grown in St. Kitts were B. H. 10(12) and Ba. 6032, with respective acre yields of 27.7 and 29.6 tons of cane and 6,350 and 5,720 lbs. of sucrose. B. H. 10(12), with 41.7 tons of cane and 8,510 lbs. of sucrose, and B. 6308, with 34.6 tons of cane and 6,280 lbs. of sucrose, were the highest-yielding ratoon canes. Observations on a number of seedlings are noted as heretofore.

In Nevis, B. H. 10(12), with 26.6 tons per acre and 7,590 lbs. of sucrose, and B. 6308, with 27.6 tons of cane and 6,960 lbs. of sucrose, were the highest-yielding plant canes. No ratoon canes were grown experimentally in Nevis.

Sealy Seedling, with 34.5 tons of cane and 7,830 lbs. of sucrose, and B. H. 10(12), with 31.3 tons of cane and 7,670 lbs. of sucrose, led in the test of plant canes in Montserrat.

Fertilizer experiments in St. Kitts, supplementing those already noted (E. S. R., 38, p. 438), showed the highest yield to accrue from combinations of readily available nitrogenous manures with potash and phosphate. However, pen manure produced increases nearly as great. Without potash and phosphate, readily available nitrogenous manures did not give marked increases in yield. The organic manures, filter-press cake and cottonseed meal, either depressed the yield or increased it but slightly.

Sunflower production for silage, E. G. Schafer and R. O. Westley (*Washington Sta. Bul. 162 (1921), pp. 5–20, figs. 4*).—Information is presented concerning the culture and probable value of sunflowers for silage, based on data from trials at the station and other sources.

At Pullman sunflowers averaged 11.59 tons of silage per acre, while corn gave but 5.97 tons. Yields at other stations and different Washington counties show sunflowers to be profitable, especially in areas not suitable for corn. Wheat following sunflowers averaged 28.4 bu. as compared with 33.8 bu. after corn, indicating that land used for sunflowers is somewhat less suitable for immediate wheat production than corn land. Rations containing sunflower silage are given for dairy and beef cattle and sheep, and notes on sunflower diseases are included.

Water as a limiting factor in the growth of white sweet clover (M. alba), A. N. HUME, H. LOOMIS, and J. G. HUTTON (*South Dakota Sta. Bul. 191 (1920), pp. 253–298, figs. 5*).—Experiments to determine to what extent water is a limiting factor in the growth of white sweet clover, conducted in pots containing sandy loam, silt loam, and clay soils representing large areas of the State are reported, and results obtained in earlier work along the same general line are reviewed at some length.

White sweet clover apparently lived with an amount of moisture equal to as little as 9 per cent of the dry weight of the loam soils and 11 per cent of the clay soils used, indicating that under otherwise identical conditions differences in soil type may produce variation in the amount of water required for the growth of this crop. These observations are said to agree with those of other investigators.

The amount of water utilized by the plant increased as the moisture content of the soil was increased. When the soil moisture was increased from 9 per cent to a maximum of 32 per cent, the total water used increased from 6.6 to 79 kg., indicating that sweet clover can adapt itself to the available water supply.

The average production of dry matter per plant increased with the total amount of water used. The extreme height of main stem also increased with an increase of available water up to 22 per cent of the dry weight of the soil. With a further increment of available water, the corresponding increase in the dry matter was produced by an increase in number of stems and branches and not by an extension in height of plant. The average weight of the leaves of plants and the mean area per leaf appeared to become greater with an increase in the amount of available moisture.

The average actual water requirement, the ratio of grams of water used to grams of air-dry tops produced, increased with an augmentation in the amount of water available up to 18 per cent of the weight of the soil. The water requirements for sweet clover varied according to the percentage of water available, from 675 to 789 lbs., substantially agreeing with those secured by Briggs and Shantz (E. S. R., 32, p. 127) for conditions at Akron, Colo.

Hubam clover (Hughes annual white sweet clover), J. F. COX, F. A. SPRAGG, and E. E. DOWN (*Michigan Sta. Circ. 45 (1921), pp. [4], fig. 1*).—Brief notes on the behavior of Hughes annual white sweet clover (E. S. R., 44, p. 431; 45, p. 132) in Michigan, with practical directions for seed production.

Sweet potato fertilizer experiments at Substation No. 2, Troup, W. S. HOTCHKISS (*Texas Sta. Bul. 277 (1921), pp. 3–7, fig. 1*).—In fertilizer experiments with sweet potatoes at Troup Substation in 1907, 1908, and 1911, acid phosphate gave the highest yield of the materials applied alone, and was followed by cottonseed meal. Potash alone averaged the lowest of any fertilizer used, and was apparently not required on the Susquehanna fine sandy loam soil. A mixture of acid phosphate and cottonseed meal gave the largest increase and the greatest net profit, and from 300 to 500 lbs. per acre of a 3:2 mixture is suggested for ordinary East Texas sweet potato soils.

[Report of plant breeding work in Arizona], W. E. BRYAN and E. H. PRESSLEY (*Arizona Sta. Rpt. 1920, pp. 480–483*).—The F_3 generation of a Turkey-Sonora wheat hybrid (E. S. R., 44, p. 524) appeared to confirm the classification of 4,581 F_2 plants grown to maturity into 983 plants with all hard grains, 2,285 with hard and soft grains, and 1,313 with all soft grains, roughly approaching the ratio 1:2:1. The two types of texture have segregated sharply in the second generation and have maintained their identity. A fair indication of a single factor difference between the two types of texture also exists. The offspring of 28 of 34 selections made from the F_2 plants that headed during the heading period of the early parent had individual ranges of heading dates approximately the same as those of the parents, with about equal deviation from the mean heading dates. These facts, together with the fairly high coefficient of heredity ($r=0.4199\pm0.0952$) and the grain texture studies, are held to indicate the possibility of producing early races of hard wheat suitable for the irrigated districts of Arizona.

Wheat production as influenced by variety, time of seeding, and source of seed, E. G. Schafer, E. F. Gaines, and O. E. Barbee (*Washington Sta. Bul. 159* (*1921*(, *pp. 5–34, figs. 10*).—The principal wheat varieties grown in Washington are described and their distribution, yields, and adapted areas indicated, and time of seeding and source of seed tests are reported.

The leading varieties with respective percentages grown in the State in 1918 and 1919 included Bluestem, 17.2; Early Baart, 16.6; Hybrid 128, 11.5; Marquis, 10.4; Jenkins Club, 9.2; Forty Fold, 9; Turkey, 7.5; Red Russian, 6.2; Hybrid 143, 3.4; Jones Fife, 3.1; and all others, 5.9. The average yields of field and nursery plantings during the period 1914 to 1919 showed Ruddy, Hybrid 128, Quadruple, Bluestem, Turkey Red, and Triplet outstanding, with yields ranging from 40 to 46.2 bu. per acre. "If Washington would reduce her wheats to the varieties Bluestem, Early Baart, Hybrid 128, Turkey Red, Jenkins Club, and possibly Marquis, and restrict them to the sections for which they are best adapted, more wheat would be raised, less mixture would be found, and the market value would be increased."

Where two varieties were seeded at 15-day intervals from August 1 to December 1, the highest yield was made from the September 1 seeding, closely followed by the August 15 seeding, indicating that crops seeded medium early render higher yields than those seeded very early or very late. The very early and very late seedings contained very little smut, but the yields were low.

Hybrid 128, a true winter, and Bluestem, a standard spring variety, were planted at week intervals from October 8 to March 25 during 1917 and 1918. Bluestem suffered much greater injury than Hybrid 128, and every planting of Bluestem from October 8 to February 11 was so badly winterkilled that reseeding would have been necessary to secure a profitable stand. Although Hybrid 128 showed some injury when seeded from October 8 to December 24, and was comparatively hardy, it failed to head out when seeded later than March 11. Spring varieties should not be seeded in the fall because of the danger of winterkilling, and winter varieties should not be seeded in the spring because they are not likely to head out.

Haynes Bluestem wheat grown continuously at the station produced slightly larger yields than seed of the same variety obtained each year from Minnesota and North Dakota. No improvement was gained by bringing seed wheat from these districts.

Cultural experiments with wheat, E. G. Schafer, E. F. Gaines, and O. E. Barbee (*Washington Sta. Bul. 160* (*1921*), *pp. 3–19, figs. 8*).—In tests begun in 1906, manure at the rate of 10 tons annually applied to spring and winter wheat increased the average acre yield of winter wheat 14.2 bu., while spring wheat made a gain of only 2.2 bu. Winter wheat unmanured yielded 3.8 bu. less than spring wheat. Manure rendered its largest return when plowed under in the fall for winter wheat. Winter wheat alternating with fallow, with manure plowed under in the spring of the fallow year, put on fallow in the summer, and put on wheat in early winter, made 6-year average acre yields of 38.7, 39.5, and 40 bu., respectively. However, the annual yields ranged from 27.5 to 49.5

bu., 26.4 to 53.3 bu., and 18.7 to 57.2 bu., respectively, with the first treatment making the highest yields during 3 out of 6 years.

Early plowed and well tilled summer fallow produced an average of 11.8 bu. more wheat than when plowed late and left untilled. Spring plowed land averaged 2.9 bu. more wheat per acre than fall plowed land during 14 years and outyielded the fall plowed 10 times during the period. Where spring wheat was grown continuously, the yields did not change materially whether the land was plowed 4, 6, 7, or 8 in. annually, or 5 and 8 in. in alternate years.

Winter wheat seed-bed preparation, L. L. Zook (*Nebraska Sta. Bul. 178* (*1921*), *pp. 16, figs. 2*).—Experiments were conducted at the North Platte Substation to study the effect on winter wheat yields of plowing at different depths, early and late plowing, and of packing and seeding without packing.

Land plowed 3, 7, 10, and 14 in. deep produced average acre yields of 13.2, 15.2, 15.3, and 14.5 bu., respectively, as compared with 12 bu. from land disked only. While the increase made by 7-in. plowing over 3-in. plowing was considered sufficient to justify the greater depth, no advantage was gained by plowing deeper than 7 in. Moisture determinations made on part of the plats showed in no instance an appreciable difference in rapidity or amount of moisture storage, or in the manner or completeness of its exhaustion whether the soil had been plowed shallow, medium, or very deep.

Although higher yields were secured from early than from late fall plowing, the gain was small and the arrangement of the plats precluded definite conclusions. Better results followed packing than where packing was not practiced, the gain being more than enough to pay for the cost of the operation.

Results of experiments conducted by the U. S. Department of Agriculture (E. S. R., 39, p. 812) on substations in 12 States are cited to show the unprofitableness of deep tillage.

The improvement of damp grain, M. Heinrich (*Landw. Vers. Sta., 90* (*1917*), *No. 1–2, pp. 49–67*).—Treatment of damp grain with a heated mixture of calcium or magnesium oxid with a bicarbonate compound, to remove excess moisture, carbonic acid, and ammonia failed to reduce the moisture content appreciably. The treatment reacted favorably on the germination of oats containing a fairly high amount of moisture, but the effect was too slight to render it of practical value. Where oats with high moisture content had free access to air, the treatment was of no practical benefit. Storing grain with high moisture content under air-tight conditions favored bacterial development detrimental to germination and vigor.

Influence of storage conditions on fresh grain (rye), M. Heinrich (*Landw. Vers. Sta., 90* (*1917*), *No. 1–2, pp. 68–112*).—Supplementing earlier work (E. S. R., 30, p. 837), the author presents results of tests of the effect of storage conditions on newly harvested rye. Tabulated notes are given on moisture content, weight of 1,000 kernels, rate, and percentage and vigor of germination of the crop, immediately after harvest, when stored under air-tight conditions, and when stored with free access of air, with daily fluctuating temperatures (10 hours at 35° C. to 14 hours at 18°), room temperature (18°), and reduced temperature (10°). Both dry and damp grain was stored under these conditions for periods ranging from 2 to 12 weeks.

Confined atmosphere with high temperatures exercised a very harmful influence on stored fresh grain. Reduced temperatures favored storage without ventilation. Although fresh grain appeared less sensitive to confined atmosphere than old grain, it was damaged sooner and to a greater extent by fungus attacks. The development of mold fungus damaged the grain less than the development of bacteria. The germ maturity of grain cut in the yellow ripe stage increased in storage when the grain was not dried out.

Ripening after harvest took place with high as well as low temperatures, being specially expedited by high temperatures. High moisture content retarded after-ripening. With free access of air, the after-ripening was in proportion to desiccation. Reduced temperatures favored rapidity of germination in fresh grain, but as soon as the full germ maturity was reached the action was retarded. With fresh as well as weather-damaged grain, cool storage had a general good effect on germination, resulting in higher final value. Germination tests are considered necessary in many cases to determine the actual degree of depreciation.

Work of the seed inspection laboratory for the year 1919, F. S. HOLMES (*Maryland Sta. Bul. 238 (1920), pp. 25–55*).—Results are reported of purity and germination tests of 1,455 official samples of seeds collected during 1919.

The important agricultural weeds, F. BORNEMANN (*Die Wichtigsten Landwirtschaftlichen Unkräuter. Berlin: Paul Parey, 1920, 2. rev. ed., pp. 146, figs. 40*).—A practical handbook, including a general discussion of weed eradication methods followed in Germany and elsewhere, and notes on the propagation, and habits of growth of individual weeds, and eradication methods effective with each.

[The use of bagasse paper in weed eradication in Hawaii] (*La. Planter, 66 (1921), No. 15, p. 236*).—The use of bagasse paper mulch to keep down weed growth in sugar cane in Oahu, Hawaii (E. S. R., 44, p. 437), has been extended to the pineapple fields. The paper is much tougher than that used in cane fields, and is strengthened by the introduction of 40 per cent spruce pulp, or sulphite, which is added to the bagasse pulp. The young pines are planted in holes cut in the paper as it spreads over the ground. The seedlings develop, while all grass and weeds under the paper are killed off through lack of sunlight and air. For cane fields the paper is made in the following widths: Thirty in. for 4 ft. rows, 33 in. for 5 ft. rows, and 36 in. for 6 ft. rows.

HORTICULTURE.

Plant culture, G. W. OLIVER and A. C. HOTTES (*New York: A. T. De La Mare Co., Inc., 1921, 4. ed. rev. and enl., pp. 442, figs. 131*).—This is a revised and enlarged edition of a work previously noted (E. S. R., 28, p. 235).

The garden and its products, R. GODINEZ Y DIEZ (*La Huerta y sus Productos. Madrid: Libr. Angel de San Martin [1916], pp. 481, figs. 121*).—A practical treatise on vegetable gardening in two parts. The first part discusses general garden operations and the second deals with cultural requirements of the various crops.

[Report of the division of] horticulture, F. J. CRIDER, A. F. KINNISON, and D. W. ALBERT (*Arizona Sta. Rpt. 1920, pp. 469–474, figs. 2*).—Brief notes are given on experiments with citrus fruits, dates, olives, walnuts, and pecans. Self-sterility studies with 24 olive varieties indicated that a majority were self sterile. A list is given of recently introduced plants under trial.

Report of the horticultural department, 1919–20, F. M. ROLFS (*Oklahoma Sta. Rpt. 1920, pp. 46–51*).—A progress report of activities for the year ending June 30, 1920 (E. S. R., 43, p. 36). Studies of the cause of blossom drop in the tomato and the development of fruit buds are noted on page 449. A list of grape varieties ripening between August 1 and August 23 is given, Lamont being the first and Lucile the last. Herbert gave the largest yield of fruit.

Report of the horticulturist, A. G. TURNEY (*New Brunswick Dept. Agr. Ann. Rpt., 1920, pp. 90–105*).—This is a report on the condition of fruit crops and markets in New Brunswick in 1920, together with notes on demonstration orchards. Data on the effect of nitrate of soda as a stimulant to fruit production and on coöperative dusting experiments are included.

Plant propagation and fruit culture in the Tropics, P. J. Wester (*Philippine Bur. Agr. Bul. 32 (1920), 2. rev. ed., pp. 134, pls. 23, figs. 54*).—A revised and enlarged edition of the bulletin previously noted (E. S. R., 35, p. 642).

Notes on plant introduction work, J. J. Thornber and J. G. Brown (*Arizona Sta. Rpt. 1920, pp. 459–463*).—Brief descriptive and behavior notes are given of 17 plant introductions being tested in the university grounds. The Evergreen tamarisk (*Tamarix articulata*) of Algerian origin is deemed particularly desirable as a shade tree on account of its symmetrical form, rapid growth, and ease of propagation. Three Pistacia species, *P. lentiscus*, *P. vera*, and *P. chinensis*, included in the list of plants, have proved adaptable to Arizona conditions.

Peas for canning industry, H. L. Russell (*Wisconsin Sta. Bul. 332 (1921), pp. 17, 18, fig. 1*).—It is noted that a cross between the Horsford and the Alaska pea has been found to be specially vigorous, and to show good seed-producing possibilities and resistance to root rot. Badger and Horal, two new early maturing wrinkled peas, are described as prolific and more evenly ripening than any other varieties tested.

The present status of dusting, H. H. Whetzel (*N. Y. State Hort. Soc. Proc., 2 (1920), pp. 45–75*).—A summary, with tabulations, of experimental results with dusting in the United States and Canada.

Some preliminary results from pruning experiments, W. H. Chandler (*N. Y. State Hort. Soc. Proc., 2 (1920), pp. 77–84*).—A preliminary report on investigations conducted at Cornell University to determine the merits of different types of pruning.

A comparative study of little pruning, pruning to a central leader, and pruning to an open head in a variety apple orchard showed a marked increase in yield in favor of little pruning. The author points out the difficulty of pruning spreading-top varieties like Rhode Island Greening, Baldwin, and Tompkins King to a central leader. Open-head pruning of plum trees did not reduce fruitfulness to such an extent as with apples. Tabulated records of the leaf area of much *v.* little-pruned apple trees showed a marked reduction in leaf surface of the much-pruned trees. Studies with nursery apple trees showed a reduction in the number of leaves and weight of top and of roots as a result of pruning. The top growth of severely pruned 2-year-old apple trees was but 57.5 per cent that of unpruned. With Elberta and Early Crawford peaches, there was a marked reduction in root growth but none in the top.

"We must conclude from these experiments that any considerable amount of pruning dwarfs the tree, generally by more than the amount of the pruning. In case of spur-bearing trees such pruning delays the fruiting of the young tree even more than it dwarfs."

Types of flowers and intersexes in grapes with reference to fruit development, A. B. Stout (*New York Sta. Tech. Bul. 82 (1921), pp. 3–16, pls. 7*).—This is the initial report of an investigation, conducted cooperatively by the station and the New York Botanical Garden. The material studied was obtained in the station vineyards at Geneva, where many named varieties of American and European grapes and several thousand seedlings of known parentage are grown. The flowers were examined under the microscope and drawings made to scale, with the aid of a Stufen ocular micrometer. The germination of the pollen was tested with 5, 7.5, and 10 per cent cane sugar in 1 per cent agar. The fertility of the pistils and ovules in the flowers was judged by production of fruit and seed in the vineyards.

The author concludes in part that "a summary of the variations in the flowers of cultivated varieties of grapes and of seedlings from them shows that there are many grades in the relative development of pistils and stamens.

"Complete loss of femaleness is seen in only a few cases, but various grades of rudimentary pistils are present that are incapable of yielding fruits of any kind. This evidence suggests that it is a weak grade of femaleness which is responsible for the development of seedless fruits. In near-seedless sorts, femaleness of still another grade but below that of high seed production.

"A complete morphological loss of stamens has not been found. The least male plants are perhaps among those with recurved stamens, small sterile anthers, and only aborted pollen. Such plants are able to function as females only. Plants with erect crinkled stamens and some plants with normal upright filaments are likewise unable to function as males because of impotent pollen. In the extreme there is complete loss of one or the other sex, at least functionally. Between these extremes there are various grades of relative development and functioning ability of pistils and stamens. In the perfect hermaphrodites both of these organs are highly developed and functional, and it is these types that include all of the most important and productive of the seeded grapes. . . .

"The variations in the morphological development of stamens and pistils and in their ability to function as sex organs are to be described as phenomena of intersexualism. The abortion of pollen in reflected, crinkled, and in other stamens is seen in flowers that are highly pistillate and functional as females. Conversely, extreme loss of femaleness is seen in staminate types in which maleness is highly developed. In these extremes the loss of sex is one-sided. Such one-sided impotence is characteristic of intersexualism as distinct from the sterility of hybridity, which tends to affect both sexes in the individual quite the same. . . .

"The results of the breeding work already obtained at the station indicate clearly that the use of seedless and near-seedless plants as male parents in crosses with varieties that are strongly female (perfect and imperfect hermaphrodites) give progeny that are strongly female and seed producing. . . .

"The most effective course in breeding for the development of seedless sorts is suggested by the conditions of intersexualism. Most individuals and varieties producing seedless or near-seedless fruits are strongly staminate. The former can be used as male parents on the latter, which do produce a few viable seeds. Plants strongly male and seedless can be crossed with plants strongly male but weakly female and near-seedless and, also, the self-fertilized progeny of the latter may be obtained. In this way families weak in femaleness may undoubtedly be obtained, in which a considerable number of individuals will produce seedless fruits."

Top-worked citrus trees, A. D. Shamel (*Calif. Citrogr., 6 (1921), No. 4, pp. 109, 134, figs. 3*).—A discussion of the principles and practice of top-working citrus trees. A table is included showing the comparative yields of top-worked *v.* all-orange trees, in which a slight advantage is indicated in favor of the latter.

Effect of season on the regeneration of sour orange roots, F. F. Halma (*Calif. Citrogr., 6 (1921), No. 8, pp. 273, 299, figs. 2*).—A brief account of a study conducted at the California Citrus Experiment Station in 1919 and 1920, in which renewal growth of sour orange roots pruned at different intervals was carefully observed.

"The results of this experiment showed that all of the 50 pruned roots regenerated, that is, each one produced a number of new roots close to the cut. The total amount of new growth varied with the size of the root." Roots which were pruned from about the beginning of May to about the last of October calloused almost immediately, and new rootlets could be observed within two weeks. "On the other hand, roots which were pruned between November and April remained inactive until the end of April." The author concludes that the investigation explains why May is the best time for transplanting citrus trees.

The coconut in Dahomey, L. HOWARD (*Bul. Matières Grasses Inst. Colon. Marseille, No. 2 (1921), pp. 25–35*).—This review of the coconut industry in Dahomey calls attention to the distribution of trees, cultural practices, present status, and future development.

Crop records of oil palms, A. A. L. RUTGERS (*Meded. Alg. Proefsta. Alg. Ver. Rubberplanters Oostkust Sumatra, Alg. Ser., No. 8 (1920), pp. 3–15, pls. 2*).—This report of investigations with the oil palm (*Elaeis guineensis*) contains information on the area in cultivation, cultural and pruning practices, and pollination and yields.

Crop records of oil palms, A. A. L. RUTGERS (*Commun. Gen. Expt. Sta. Alg. Ver. Rubberplanters Oostkust Sumatra, Gen. Ser., No. 8 (1920), pp. 3–13, pls. 5*).—An English translation of the above.

Nut growing in the United States, W. G. BIXBY (*North. Nut Growers Assoc. Bul. 5 (1920), pp. 20, pls. 2*).—Practical information is given on nut production in the United States, with reference to species and their varieties, improvement, cultural practices, and yields.

Nut culture in Michigan, C. A. REED (*North. Nut Growers Assoc. Proc., 10 (1919), pp. 98–107*).—A paper on the status of nut growing in Michigan, with particular reference to 11 species which are considered to be available for use in that State.

The practical book of outdoor rose growing for the home garden, G. C. THOMAS, JR. (*Philadelphia and London: J. B. Lippincott Co., 1920 [5. ed.], rev., pp. 224, pls. 43*).—This revised edition (E. S. R., 37, p. 836) contains an additional chapter entitled Rose Development from 1917 to 1920 (pp. 219–224).

Landscape gardening, A. J. DOWNING, rev. by F. A. WAUGH (*New York: John Wiley & Sons, Inc.; London: Chapman & Hall, Ltd., 1921, 10. ed., rev., pp. XV+439, pl. 1, figs. 48*).—The purpose of this new edition, extensively rearranged and modified by the addition of chapters from Downing's Rural Essays, is, in the editor's words, "not so much to make the usual revision of an old book as to bring together from all Mr. Downing's writings the best portions of his work bearing directly on the subject of landscape gardening."

Appendix II, a memoir to the author by G. W. Curtis, presents a review of his life and activities.

The rock garden, E. H. JENKINS (*London: Country Life, Ltd.; New York: Charles Scribner's Sons, 1920, new ed., rev. and enl., pp. XI+128, pls. 44, figs. 3*).—A revised edition of the work previously noted (E. S. R., 31, p. 743).

FORESTRY.

Forestry for the private owner, F. F. MOON and H. C. BELYEA (*N. Y. State Col. Forestry, Syracuse Univ., Bul. 13 (1920), pp. XIV+166, pls. 15, figs. 15*).—A handbook of forestry prepared for the assistance of the private owner, emphasizing the necessity of reforestation of idle and unprofitable lands and presenting information relative to desirable species, protection from fire, insects and diseases, thinning, harvesting and marketing, etc. A bibliography is included. Surveyor's log rule and volume tables are appended, together with a tabulation of the uses of various woods.

Results of experimental planting at Parilla Forest, W. Gill (*Jour. Dept. Agr. So. Aust., 24 (1921), No. 6, pp. 476, 478–480*).—An experimental tree planting in the Pinnaroo district of South Australia in an attempt to grow sufficient timber to supply posts, etc., for the settlers is described. Due to meager rainfall, 12.69 in. per year over a 10-year period, none of the tested species made a satisfactory growth.

Growth and its relation to thinning—sample plat studies in mixed hardwoods, C. H. Guise (*Jour. Forestry, 19 (1921), No. 5, pp. 546–549*).—In an experiment conducted in a young, mixed hardwood stand near Mapleton, N. Y., to determine the effect of thinning on the rate and amount of growth, three square, quarter-acre plats were laid out, one check, one lightly thinned, and one severely thinned. The diameter of every tree in each plat was determined and each tree labeled, and at the end of a five-year period the diameters were again determined. The results, presented in tabular form, show that the greatest increases in diameter and volume growth occurred in the severely thinned plat; however, the greatest actual volume was found on the check plat. The mortality rate was 4.9 per cent for the check plat, as compared with none for the severely thinned plat.

Report of the division of forestry (*Mass. Comn. Conserv. and State Forester Ann. Rpt., 1920, pp. 29–60, pls. 3*).—A report of forest activities in Massachusetts for the year ended November 30, 1920, relative to changes in organization, State plantations, examinations, nursery work, distribution of seedlings, forest survey of Hampshire County, white pine blister rust, white pine weevil, and administration of the State forests. The State Fire Warden's Report, by M. C. Hutchins (pp. 45–52) and the Report of the Superintendent of Gypsy-moth work, by G. A. Smith (pp. 53–60) are included.

Biennial report of the Forestry Commission for the two fiscal years ending August 31, 1920 (*N. H. State Forestry Comn. Bien. Rpt., 1919–20, pp. 89, pls. 3*).—A report of the activities of the commission for the period, giving information on forest fire service, control work with white pine blister rust, public forests, reforestation, survey of forest resources, the Christmas tree industry, the chestnut bark disease, taxation of forest land, etc. A financial statement is included.

Forest trees in the National Arboretum, L. Pardé (*Rev. Eaux et Forêts, 59 (1921), Nos. 5, pp. 134–138; 6, pp. 166–173*).—A report on the behavior of broadleaf and coniferous tree species introduced into the National Arboretum at Barres, France, during the period 1900–1920. Among the satisfactory species are *Thuja plicata*, *Libocedrus decurrens*, *Sequoia washingtoniana*, *S. sempervirens*, *Pinus laricio*, *Cedrus atlantica*, *Picea sitchensis*, *Abies nordmanniana*, and *Pseudotsuga taxifolia*.

Choice of species for use in plantations of pulp and paper companies in the North, H. B. Shepard (*Jour. Forestry, 19 (1921), No. 5, pp. 519–525*).—The adaptability of four spruce species, *Picea canadensis*, *P. rubens*, *P. mariana*, and *P. excelsa*, as material for reforestation with a view to pulp-wood production is discussed. *P. canadensis*, the white spruce, is deemed the most valuable because of its rapid growth, resistance to pests, adaptability to environment, and abundant seed supply. *P. excelsa*, the Norway spruce, is considered of possible value but not sufficiently tested.

The quebracho forests of South America, G. A. Kerr (*Jour. Amer. Leather Chem. Assoc., 16 (1921), No. 4, pp. 172–202, figs. 18*).—In this article, based on personal observations upon the quebracho forests of Argentina and Paraguay, Colorado is described as the most abundant and important of three varieties and the chief source of a very important tanning extract. Data are presented on the distribution, total resources, value, physical aspect of the tree and forests, and operations and transportation.

Wood charcoal and its manufacture, J. J. KOTZÉ (*Union So. Africa, Forest Dept. Bul. 1 (1920), rev., pp. 17, figs. 14*).—The process of charcoal burning is described and illustrated.

DISEASES OF PLANTS.

Notes on new or little known plant diseases in North Carolina in 1920, F. A. WOLF and S. G. LEHMAN (*North Carolina Sta. Rpt. 1920, pp. 55–58*).—Brief notes are given on a number of diseases observed by the authors that are thought to be worthy of permanent record. Among them are lightning injury, and associated with it, *Phoma corvina;* a root mold of cotton caused by *Penicillium spiculisporum;* a pod rot of cowpeas due to *Choanephora cucurbitarum;* pod blight of lima bean caused by *Diaporthe phaseolorum;* anthracnose (*Glomerella cingulata*) of fig; a soft rot of pepper fruits due to *Pythium debaryanum;* mosaic, anthracnose (*G. cingulata*), and Phoma blight (*Phoma* sp.) attacking soy beans; the buckeye rot of tomato (*Phytophthora terrestria*); and downy mildew of vetch, caused by *Peronospora viciae.*

Annual report of the department of plant pathology and botany, 1919–20, J. MATZ (*Porto Rico Dept. Agr. and Labor Sta. Ann. Rpt., 1920, pp. 91–93*).—Notes are given on a number of plant diseases in addition to the studies of yellow-stripe disease and root diseases of sugar cane. Among the root diseases the author reports having discovered *Plasmodiophora vascularum* in the vascular bundles of stunted cane, and a survey made of the island showed that the organism, which is apparently an important factor in cane production, is quite extensively distributed. Some investigations were made of the gumming of sugar cane due to *Bacterium vascularum.*

Studies were also made of a new tobacco disease caused by *Phytophthora terrestria*, and the same fungus was found in the diseased lesions of grapefruit tree trunks.

[Plant diseases, British Guiana], J. B. HARRISON (*Brit. Guiana Dept. Sci. and Agr. Rpt., 1918, pp. 16, 21, 24*).—Sugar cane root disease (*Marasmius sacchari*) showed sporadically in several plantations during the year. Ring spot (*Leptosphaeria sacchari*), rind fungus (*Melanconium sacchari*), and the leaf-sheath fungus (*Cercospora vaginae*) caused little damage, owing to increased host resistance due to favorable weather. Coconut bud rot, thought to be due to bad conditions, chiefly inadequate drainage, is controlled by employment of proper management and suitable soil. Para rubber leaf disease is still serious in some localities.

Plant diseases, [British Guiana], R. WARD (*Brit. Guiana Dept. Sci. and Agr. Rpt., 1918, p. 52*).—Para rubber disease continued prevalent at two points named. Coconut bud rot was associated with inadequate drainage. Mango and breadfruit ripe rot, prevalent in 1918, proved controllable by use of Bordeaux mixture. Cacao witches' broom was less prevalent than formerly. *Marasmius sacchari* was the most prevalent disease of sugar cane.

Report on activities of the Station of Agricultural Intelligence at Montpellier, 1918, L. RAVAZ (*Ann. École Natl. Agr. Montpellier, n. ser., 17 (1919), No. 2, pp. 131–167, figs. 27*).—A brief account is given of the establishment (following a severe freeze on March 26, 1898) of the service of meteorological and agricultural information. This is followed by a detailed account, brought down to include 1918, of the development and workings of plans looking to the prevision, and, so far as possible, the prevention of grape diseases.

Cryptogamic review for 1916, with report on cereal diseases due to vegetable parasites, G. Briosi (*Bol. Min. Agr. e Indus., Com. ed Lavoro* [*Italy*], *Ser. B, 17* (*1918*), *I, No. 1–6, pp. 1–9*).—On the plan of previous reports (E. S. R., 38, p. 351), this deals briefly with diseases of rye, oats, barley, maize, grapes, garden plants, fruits, and ornamentals. Publications issued during 1916 are listed.

The Swedish Gymnosporangiums, their hosts and specialization, J. Eriksson (*K. Svenska Vetensk. Akad. Handl., 59* (*1918*), *No. 6, pp. 82, pls. 4, figs. 13*).—This contribution reports in considerable detail studies by the author on *G. clavariaeforme* and *G. tremelloides* and on their aecidial stages. A bibliography is appended.

[Report on] stations for recording Peronospora [outbreaks and phases], 1917, P. Voglino (*Bol. Min. Agr. e Indust., Com. ed Lavoro* [*Italy*], *Ser. B, 17* (*1918*), *I, No. 1–6, pp. 25–30*).—The system of reporting Peronospora outbreaks initiated in 1916 was in operation during 1917. An account is given, with discussion, of observational data with tabulation of a series of outbreaks extending from May 2 to August 3, during which time 19 records were made and 8 treatments were used.

Glomerella cingulata and its conidial forms, Gloeosporium piperatum and Colletotrichum nigrum on chilies and Carica papaya, J. F. Dastur (*Ann. Appl. Biol., 6* (*1920*), *No. 4, pp. 245–268, pl. 1*).—*G. piperatum* and *C. nigrum*, though causing much loss of fruit in Burma, are not known to be destructive to chilies in India. These fungi are considered to be identical and to be forms of *Glomerella cingulata*, which is said to be synonymous with *Gnomoniopsis* (*Glomerella*) *piperata*, the ascogenous stage of *G. piperatum*.

A new disease of *Carica papaya* is described, as caused by the conidial forms of a Glomerella showing characters indentical with those of the form found on chilies.

The study of the conidial forms of the Glomerella on *C. papaya* also shows that Gloeosporium and Colletotrichum are one and the same fungus.

A nematode disease of red clover and strawberry in the Pacific Northwest, L. P. Byars (*Phytopathology, 10* (*1920*), *No. 2, pp. 91–95, pls. 2*).—A description is given of the nematode disease caused by *Tylenchus dipsaci*, which has been observed on red clover in irrigated fields of Idaho and Utah, and on strawberries in Oregon and elsewhere. Usually the nematode attacks only the above-ground parts of the plant, and often closely associated with it on the clover are a number of other organisms, which appear to assist in a secondary manner in causing the trouble. No consistent morphological differences have been observed between the nematode occurring on the strawberry and red clover.

The author reports finding the nematode attacking only one wild plant, *Physalis* sp., which was growing in a badly diseased field of clover in Utah. For the present it is considered inadvisable to plant on infested lands any of the crops which are known to be damaged by this nematode. The more important of these crops are beans, potatoes, onions, peas, alfalfa, and most of the clovers, vetches, and grains.

[Seed treatment for cereal smuts], L. Malpeaux (*Vie Agr. et Rurale, 9* (*1920*), *No. 44, pp. 260–264, figs. 2*).—An account is given of injury to cereals due to rusts during 1920, and (in tabular form) of experimentation on seed treatments for smuts, with discussion of practical measures in this connection.

Report on the results of experiments on the treatment of oats for the prevention of smut, W. W. Philip (*Dumfries, Scot.: J. Maxwell & Son, 1916, pp. 10; noted in Scot. Jour. Agr., 2* (*1919*), *No. 2, pp. 222, 223*).—Of the four treatments employed in these tests, viz, copper sulphate, hot water, a patent smut dressing, and formalin at the rate of a half pint (of the 40 per cent solution) in 18 gal. water to 20 bu. oats, only the last mentioned treatment proved to be efficacious in 1915, giving a substantial increase during that year. Repetition of this treatment on a larger scale (42 acres in 1916 an 112 in 1917) gave like results.

How to protect wheat: Some notes on fungus pests (*Jour. Min. Agr.* [*London*], *27* (*1920*), *No. 6, pp. 548–553, fig. 1*).—Though diseases of wheat are said to have been very numerous in Great Britain in 1920, the most serious were probably bunt or stinking smut, yellow rust, and black rust. These are discussed in connection with known or proposed measures for decreasing loss due to these causes.

The occurrence of wheat downy mildew in the United States, W. H. Weston, jr. (*U. S. Dept. Agr., Dept. Circ. 186* (*1921*), *pp. 6*).—The author reports the occurrence of the downy mildew of wheat due to *Sclerospora macrospora* in Tennessee and Kentucky. A preliminary study made of the district in which the disease was discovered shows that it is restricted almost entirely to low-lying, poorly drained fields or parts of fields in which the seedlings had been subjected to excessive moisture. In addition to the varieties of wheat commonly cultivated in the region, it was also found on *Bromus commutatus.* The losses occasioned by this disease both in the west Tennessee and Kentucky districts as reported are said to be apparently very slight, but the author desires to call the attention of plant pathologists to this disease so that its distribution may be discovered as soon as possible.

Septoria glume blotch of wheat, H. R. Rosen (*Arkansas Sta. Bul. 175* (*1921*), *pp. 3–17, figs. 4*).—A description is given of a marked spotting of glumes and rachises of a large number of wheat varieties which has been under observation in Arkansas for several years. The most conspicuous symptoms are said to be on the glumes, particularly the outer ones, which are noticeably discolored, the discoloration appearing as brownish or purplish-brown spots or blotches, often with a hoary appearance, or brownish with a grayish-white center. While the glumes, including the beards in bearded varieties, are the most likely to be attacked, discolored spots may also be observed on any part of the head.

A study has been made of the fungus, and its characteristics are said to agree very well with those described by Berkeley for *Septoria nodorum.* Infection experiments were carried on by the author with the fungus and the symptoms produced were very similar to those occurring under natural infections. No experiments were undertaken to control the disease, but it is thought that the use of early maturing varieties and proper crop rotation would help in controlling the disease.

Take-all disease in wheat, R. Waters (*New Zeal. Jour. Agr., 20* (*1920*), *No. 3, pp. 137–143, figs. 3*).—This note deals with the incidence of take-all (*Ophiobolus graminis*) in New Zealand, its similarities to other diseases, its perpetuation, the susceptibility of wheat and other plants, and control measures. These include the rolling and burning of stubble, drainage, suppression of susceptible plants, rotation, and destruction of straw from infected areas.

Varietal susceptibility of beans to rust, F. D. Fromme and S. A. Wingard (*Jour. Agr. Research* [*U. S.*], *21* (*1921*), *No. 6, pp. 385–404, pls. 5*).—In a previous publication (E. S. R., 40, p. 845) the authors described the field behavior of a large number of bean varieties with respect to their susceptibility to rust. In the present paper, which is a contribution from the Virginia Experiment Station, the various phenomena found in bean rust infection and development on certain varieties of beans, especially under greenhouse conditions, are described. Considerable attention has been paid to methods of investigation, and the technique of inoculation and method of record are described, the latter being believed to be a satisfactory method for expression of the relative rust susceptibility of bean varieties.

Of the varieties studied, those with indeterminate growth (pole beans) were found more susceptible than those with determinate growth (bush beans). Green-pod varieties were found more susceptible than wax-pod beans, and varieties having solid red or red-mottled seed were rust resistant, while varieties with white seed were more susceptible to the disease than those of any other color. Varieties of beans of the marrow type were found rust resistant, and those of the pea-bean type proved to be the most susceptible class. Field tests which supplemented the greenhouse tests are said to have demonstrated that greenhouse tests afforded a reliable index of the field behavior of a variety with respect to rust infection.

The authors made some studies relative to the appearance of biologic forms of the bean-rust fungus, and the existence of two biologic forms was demonstrated, but the host ranges have not yet been completely worked out.

A mosaic disease of cabbage as revealed by its nitrogen constituents, S. L. Jodidi, S. C. Moulton, and K. S. Markley (*Jour. Amer. Chem. Soc., 42 (1920), No. 9, pp. 1883–1892*).—A disease of cabbage, marked by dwarfing, certain color changes, metallic luster, brittleness, defective root development, and other changes all tending toward lessened crop returns, was investigated in 1918 by using, along with other methods, those employed in the study of spinach disease as noted on page 448.

This cabbage disease is characterized by denitrification in the affected tissues. The nitrates are in part changed to ammonia which is lost as such, in part to nitrites which bring about the elimination of elementary nitrogen. Leaves suffer denitrification in much higher degree than do the roots. Diseased tissues show an increased proportion of protein and protein nitrogen. This is thought to indicate that affected plants build proteins from lower nitrogenous compounds, and that the protein nitrogen is not attacked by nitrous acid, the protein and protein nitrogen being related in the diseased plants to a smaller nitrogen content and a smaller quantity of tissue. Significant differences between healthy and diseased cabbage plants are discussed.

Heart rot, rib rot, and leaf spot of Chinese cabbages, N. A. Brown and R. B. Harvey (*Phytopathology, 10 (1920), No. 2, pp. 81–90, figs. 4*).—The authors report that Chinese cabbage, both loose and tight-headed varieties, is subject to the black rot disease produced by *Bacterium campestre*. The disease is said to be very destructive in seasons of high temperature with excessive moisture. The organism was found to enter the plant through the water pores of the leaf and through the wounds in roots and stem. Insects were also found to act as carriers. The soft rot organism destroys the heart at once. The spotting occurring on the leaves is unlike that due to the fungus *Alternaria brassicae*, which is confined to the outer leaves of the head.

For the prevention of the disease the practice of sanitary methods in the fields and the treatment of the seed with corrosive sublimate solution or formalin are recommended.

Treatment of celery seed for the control of Septoria blight, W. S. Krout (*Jour. Agr. Research [U. S.], 21 (1921), No. 5, pp. 369–372*).—In a contribution from the Massachusetts Experiment Station, the author gives the results of a study of the effect of aging celery seed on the vitality of the spores and mycelium of *S. petroselini apii*, and the use of hot water as a disinfectant. Tests were made of the germination of celery seed of different ages in connection with the occurrence of the fungus, and it was found that by purchasing seed 1 or 2 years old and retaining it until it was 3 or 4 years old the grower could not only eliminate the fungus but also have an opportunity to test the seed for pureness of strain, quality of plant produced, and elimination of seed weak in vitality.

The vitality of the conidia and the mycelium of the fungus was found to be very low at the end of 1 or 2 years. Celery seed 3 or 4 years old gave good germination.

When the seed was treated with hot water the vitality of spores and mycelium in the pericarp was found to be destroyed at 48 to 49° C. (118.4 to 120.2° F.) without seriously injurying the germinating power of the seed.

Choanephora cucurbitarum on chilies (Capsicum spp.), J. F. Dastur (*Ann. Bot.* [*London*], *34* (*1920*), *No. 135*, *pp. 399–403 pl. 1*).—An account is given of the new disease of chilies ascribed to *C. cucurbitarum*, showing as a wet rot and drooping of the infected tender parts and a die-back of the branches. The infection may start from the flowers or more rarely from the flower buds. Sporangia, chlamydospores, and zygospores develop in cultures, conidia apparently only on the host under natural conditions.

Impairment of clover seedings reported, A. D. Selby and R. C. Thomas (*Ohio Sta. Mo. Bul.*, *6* (*1921*), *No. 5–6*, *pp. 90–92*).—A popular account is given of a serious root rot of red clover that has been observed in different parts of Ohio. The disease appears to be due to a species of Fusarium which causes much wilting and dying of the growing parts of the plants. On account of the possible relation of this disease to corn root rot and wheat scab, observations are being conducted to determine the effect of the use of infected wheat straw applied with manure on the occurrence of the disease.

Clover stem rot (*Min. Agr. and Fisheries* [*London*], *Leaflet 271* (*1020*), *pp. 6*, *figs. 3*).—Clover stem rot may be due to the nematode *Tylenchus devastatrix* or to the fungus *Sclerotinia trifoliorum*. A description is given of the fungus disease, with points of distinction between this and the nematode disease.

Potato tuber diseases (*Meded. Phytopath, Dienst Wageningen*, *No. 9* (*1919*), *pp. 12*, *pls. 3*).—Potato tuber diseases here discussed in connection with control measures include Rhizoctonia disease (*R. solani*), lenticel outgrowths (which are to be distinguished from wart disease, which is also discussed), Fusarium rot, ordinary scab or scurf (*Oospora scabies*), misshapen tubers, red rot (*Phytophthora erythroseptica*), green tubers, late blight, silver scurf (*Spondylocladium atrovirens*, *Phellomyces sclerotiophorus*), leaf curl (*Verticillium* sp.), bacterial and undetermined diseases described, nematode attack (*Tylenchus devastatrix*), and powdery scab (*Spongospora subterranea*).

Degeneracy in potatoes, S. Mottet (*Jour. Agr. Prat.*, *n. ser.*, *33* (*1920*), *No. 14*, *pp. 237–239*, *figs. 2*).—A brief account is given of conditions associated with splindling sprout of potato. This appears in different varieties and may show in different degrees in the several sprouts on the same potato, but has not yet been successfully identified as to its causation, though associated conditions are noted herein.

Potato leaf roll, D. Folsom (*Maine Sta. Bul. 297* (*1921*), *pp. 37–52*, *pls. 4*, *figs. 3*).—This bulletin is designed to present the more essential facts presented in another publication (E. S. R. 45, p. 145), relating to leaf roll, net-necrosis, and spindling-sprout of the Irish potato.

Summarizing the investigation, the author states that leaf roll is very prevalent in a number of portions of the United States and is increasing in Maine. It causes a rolling, rigidity, and discoloration of the leaves, dwarfing of the plant, net-necrosis of the tubers, and a great reduction of the yield. The cause of leaf roll is said to be located in the juice of the plant, is transmitted into the tubers, and can not be reached by applications upon the outside of the plant or tubers. The disease is infectious and can be transmitted from one plant to another by plant lice, but by no other means thus far tested except grafting. Leaf roll has been controlled in northeastern Maine by tuber selection and roguing. Where plant lice are abundant or leaf roll very prevalent, it is thought probable that additional precautions, such as isolation of seed plats and spraying for the control of plant lice, may be required.

Transmission of the mosaic disease of Irish potatoes (*Maine Sta. Bul. 295* (*1920*), *pp. 223, 224*).—An abstract of a paper previously noted (E. S. R., 43, p. 546).

A disease-resistant potato for southern markets, H. L. Russell (*Wisconsin Sta. Bul. 332* (*1921*), *p. 28*).—Attention is called to a strain of Triumph potatoes that has shown remarkable resistance to mosaic. This strain was distributed to growers in 1920, and about three carloads of potatoes are said to be available for 1921 plantings, either in Wisconsin or in the South, for early potato production.

Potato scab, J. W. Brann and R. E. Vaughan (*Wisconsin Sta. Bul. 331* (*1921*), *pp. 27, figs. 11*).—A description is given of potato scab with suggestions for its control. The most satisfactory treatment has been found to be soaking the potatoes from 1½ to 2 hours in a solution of corrosive sublimate, 4 oz. to 30 gal. of water. Formaldehyde was also tested and gave some measure of control, but was not as satisfactory as the corrosive sublimate treatment.

As the solution loses strength with repeated use, the authors recommend the adding of ⅝ oz. of corrosive sublimate after treating each 4 bu. and restoring the volume of water to the original 30 gal.

Streak disease of potato, W. A. Orton (*Phytopathology, 10* (*1920*), *No. 2, pp. 97–100, pl. 1, fig. 1*).—The author places on record observations regarding a disease of potatoes designated as the streak disease.

This disease affects the foliage, attacks full-grown and otherwise normal, healthy plants, and frequently progresses so rapidly as to destroy them. Shortly after its appearance on the leaflets, the petiole will be found affected and slightly discolored by longitudinal streaks. The petiole later collapses, the leaf withers and hangs limp, or the petiole breaks at the point of attachment to the stem and hangs by a thread in a dead and dried condition. Marked varietal differences have been observed in regard to the occurrence of this disease, the nature of which is still in doubt.

The mosaic disease of spinach as characterized by its nitrogen constituents, S. L. Jodidi, S. C. Moulton, and K. S. Markley (*Jour. Amer. Chem. Soc., 42* (*1920*), *No. 5, pp. 1061–1070*).—To data by True and others, as previously noted (E. S. R., 40, p. 450), the authors add the results of a study begun in April, 1918. These, as presented and interpreted, are considered to warrant the conclusions that spinach plants, especially their tops, when affected with mosaic disease have a smaller percentage of total nitrate, acid amid and mono and diamino nitrogen, and a somewhat larger percentage of ammonia than normal plants, nitrous acid being present only in diseased plants. This is considered due to the fact that denitrification takes place, nitrates being reduced to nitrites, which, reacting on the various nitrogenous compounds present, bring about elimination of nitrogen in a free state and in the form of ammonia. Little, if any, denitrification occurs in diseased spinach roots. Conditions with regard to peptid and protein nitrogen are apparently somewhat complicated.

In round figures, spinach nitrogen is made up of 55 per cent protein nitrogen, 4.5 per cent diamino nitrogen, 5.5 per cent monoamino nitrogen, and 6 per cent peptid nitrogen; more than 70 per cent of the nitrogenous compounds in spinach having direct nutritive value.

Root disease in cane and suggestions for its control [in South Africa], P. A. van der Bijl (*Union So. Africa, Dept. Agr. Bul. 4 (1918), pp. 15, pls. 5*).—This pamphlet gives an account of work still in progress on a sugar cane root disease which is provisionally referred to a soil fungus, *Marasmius* sp. Evidence has been obtained of the agency in this connection of another fungus.

The fungus appears to be weakly parasitic. The main injury results from its smothering the buds, thus causing a poor stand of cane, also from its invasion of the roots and stunting the growth of the canes. Not all cases of invasion lead to notable injury, however.

Apparently the fungus is native, and is transmitted by contact with plant material, or in such material when diseased. Suggestions are offered regarding its control.

The mode of infection by smut in sugar cane, J. F. Dastur (*Ann. Bot. [London], 34 (1920), No. 135, pp. 391–397, figs. 10*).—Inoculation experiments as here outlined are claimed to show that infection of sugar cane with smut (*Ustilago sacchari*) takes place through the buds only, the germinating sporidia penetrating the young, thin-walled scale hairs, but not the ends of the cuttings. A bud can produce a spore-bearing shoot within two months after infection. Diseased cuttings give rise to diseased shoots.

Chemical variations in yellow-striped cane, F. A. López Domínguez (*Porto Rico Dept. Agr. and Labor Sta. Ann. Rpt., 1920, pp. 77, 78*).—In a report on the investigational work in progress, it is stated that an investigation was made by E. D. Colón to determine what effect, if any, the yellow-stripe disease of sugar cane had on the chlorophyll of the leaves. Spectroscopic observations showed that the spectrum of alcoholic solutions of the chlorophyll of diseased and healthy cane did not differ in any respect, indicating that the nature of the pigment was not altered by the disease.

Another investigation was made to determine whether the yellow-stripe disease caused any inversion of the sucrose in the cane. The results obtained are held to show that the disease had no effect on the sucrose content of the cane, and that it is only when the stalk cracks as a result of the drying process induced by the disease that inversion occurs.

Investigation of dry rot in swedes, E. B. Levy (*New Zeal. Jour. Agr., 19 (1919), No. 4, pp. 223–228*).—Trials of measures for control of swede dry rot were inaugurated in 1918 and carried out at four centers in Southland, where the disease is severe. The experimentation, including manurial, variety, and seed-origin trials, is reported in tabular form, with discussion of details.

In nearly every case the better the crops in an affected area, the more subject they were to the disease. Seed from different localities differed as regards susceptibility. Variety tests indicate that while none are immune, some exceed others in resistance, offering a start for the breeding of resistant strains.

Blossom drop of tomatoes, F. M. Rolfs (*Oklahoma Sta. Rpt. 1920, pp. 47–49*).—Studies were made of weather conditions, and particularly moisture factors, in connection with the setting of tomatoes in Oklahoma. Evidence has been secured which seems to indicate that moisture is an important factor in the setting of tomato fruit, and that straw mulch is an efficient conserver of soil moisture.

Notes are given on the attack of Fusarium on some of the plants and also the relative resistance of varieties to Fusarium diseases and attacks on fruit late in the season by a species of Phoma. Some injury due to *Septoria lycopersici* is also reported.

Infection experiments on tomatoes with Phytophthora terrestria and a hot-water treatment of the fruit, J. Rosenbaum (*Phytopathology, 10 (1920), No. 2, pp. 101–105*).—As a result of studies made by the author it has been found that an abundant moisture supply, preferably free water, in infected soil, is a necessary condition for producing an epidemic infection with *P. terrestria* on tomatoes. The addition of a 1:5,000 solution of copper sulphate to infected soil is said to prevent infection of green tomatoes when in contact with such soil. The immersion of green tomatoes in water at 60° C. for 1.5 minutes was found to prevent the spread of the buckeye rot where the infection was very recent and the fungus had not penetrated deeply into the tissues.

A bacterial leaf spot of velvet bean, F. A. Wolf (*Phytopathology, 10* (*1920*), *No. 2, pp. 73–80, figs. 2*).—The author reports noticing a leaf spot of the Florida velvet bean near West Raleigh, N. C., in 1916. Since that time the disease has been observed to be more or less destructive in the same locality, and specimens have been procured of the disease in widely separated portions of the State. The disease is said to be restricted to the leaves, on which it first becomes apparent as translucent areas, turning at length to dark brown in color. The cause of the organism is said to be a bacterium and is described as a new species under the name *Aplanobacter stizolobii.* Inoculation experiments have shown that it has an incubation period of about four days, infection occurring through the stomata. The invasion at first is intercellular but later becomes intracellular, and only parenchyma tissues are involved.

Development of fruit buds, F. M. Rolfs (*Oklahoma Sta. Rpt. 1920, p. 49*).—In connection with a report of a study of the development of fruit buds, the author states that apple blotch (*Phyllosticta solitaria*) is particularly prevalent in Oklahoma, and that it matures its spores earlier than is usually supposed. Much winterkilling of fruit buds is reported in the State, and in most cases the killing was found to be due to excessive development of the buds during the fall. It is hoped that methods of treatment will be worked out so that fruit buds may enter the dormant period in a well-matured condition.

Cherry leaf spot or yellow leaf, G. H. Coons (*Michigan Sta. Quart. Bul., 3* (*1921*), *No. 3, pp. 93–96, figs. 2*).—The life history and effects of the fungus causing cherry leaf spot are popularly described. The author gives suggestions for the control of the disease, consisting of the turning under of all fallen leaves early in the spring, followed by spraying with either dilute lime sulphur or Bordeaux mixture, three applications to be given, the first when the petals fall, the second about three weeks later, and the third directly after the fruit is picked.

Phony peaches: A disease occurring in middle Georgia, D. C. Neal (*Phytopathology, 10* (*1920*), *No. 2, pp. 106–109, pl. 1, fig. 1*).—A description is given of a disease of peaches which is said to occur in Georgia. The disease is characterized by the leaves being somewhat larger than normal and of a dark green color. Twigs of trees having this disease are particularly noticeable on account of their short, stubby growth, and as a result of the disease the entire head of the tree is reduced to a rather compact shape. The disease is believed to be one of the so-called physiological diseases.

The amount of fruit produced by trees attacked by this disease is said to be small. Field observations seem to indicate that trees which have reached the bearing age are more susceptible, although the disease has been found on seedlings which were in their sixth season's growth.

Brown rot of plums and cherries, C. W. Michel (*So. Dak. State Hort. Soc. Ann. Rpt., 14* (*1917*), *pp. 186, 187*).—Brown rot, recognized as the most destructive disease of stone fruits, can be perfectly controlled by careful treatment, including destruction of diseased material and spraying with self-boiled lime sulphur. Three applications of this preparation are considered sufficient if a pressure not less than 200 lbs. is employed.

Lime-sulphur spray following Bordeaux (*New Zeal. Jour. Agr., 19 (1919), No. 6, pp. 371–374*).—Tests as to the alleged burning (russeting) due to the use of lime sulphur following Bordeaux mixture used to control black spot were carried out at two points.

At Arataki fruit on trees twice sprayed with Bordeaux mixture looked well in case of some varieties, while in others it appeared dull or slightly scorched. Foliage was normal on all trees but one treated with 6:4:50 Bordeaux at open-cluster and with 1:80 lime sulphur when the fruit had set, the fruit being practically clean and the yield normal.

At the Papanui orchard, lime sulphur following Bordeaux mixture did not reduce the crop. Black spot was kept well in check, and the foliage looked healthier than where Bordeaux mixture alone was used.

Fruit tree rots, E. Noffray (*Jour. Agr. Prat., n. ser., 32 (1919), No. 12, pp. 244–246*).—Two root rots, due respectively to *Dematophora necatrix* and *Armillaria mellea*, are discussed as to symptoms, effects, and treatments.

Winter injury of berries, J. L. Stahl and A. Frank (*Washington Sta., West. Wash. Sta. Bimo. Bul., 9 (1921), No. 3, pp. 34–36, fig. 1*).—Popular descriptions are given of winter injury to the canes of berry plants. Some of the factors which induce a tendency toward injury by frost are mentioned, and suggestions are given for the proper maturity of canes to prevent winter injury.

Grape anthracnose, E. Noffray (*Jour. Agr. Prat., n. ser., 32 (1919), No. 39, p. 795*).—A brief discussion is given of grape anthracnose (*Gloeosporium ampelophagum*) and of means and conditions related to its control.

Citrus gummosis and a new preventive and curative remedy, M. S. Bertoni (*An. Cient. Paraguay, Ser. II, 1919, No. 5, pp. 408–421, figs. 2*).—Citrus gummosis, which has been associated with *Bacillus gummificans* and other factors, is said to cause severe and increasing loss throughout the La Plata Basin. It is stated that in shaded situations citrus is not attacked by gummosis, and that even after it appears it may be greatly checked by the use of artificial shade. This fact is considered to afford strong evidence in favor of the view that the cause or essential condition of citrus gummosis lies in faulty nutrition and physiological changes, due to lack of balance between the organic functions and particularly between water uptake and evaporation.

The relation of certain greenhouse pests to the transmission of a geranium leaf spot, P. Garman (*Maryland Sta. Bul. 239 (1920), pp. 57–80, figs. 7*).—The author reports that the rejection of a shipment of several thousand geranium plants resulted in their examination and discovery of severe insect stigmonose and a number of fungus troubles. Further investigations have shown that the principal fungus concerned in this disease, which is designated as circular spot, is *Cercospora brunkii*. Studies were made of this organism, and the possibility of the transmission of the disease by mites, red spiders, and white flies was investigated. Insects were found to play a very small part, if any, in the transmission of the disease, but it appears that the spreading of the circular spot is due to methods of watering. Control of the leaf spot may be obtained by applications of Bordeaux mixture. Good ventilation should be provided wherever possible and every precaution taken to prevent excessive humidity or dampness.

Brown bast [in Hevea] (*Pubs. Nederland.-Indisch Landb. Synd., 11 (1919), No. 11, pp. 83–98*).—A systematic review is given of Hevea brown bast, the causation of which has not been discovered, though it is suspected to be due to an organism.

Late seasonal production of aecia of Cronartium ribicola, H. H. York (*Phytopathology, 10 (1920), No. 2, p. 111*).—The author reports the observation of freshly matured aecia of *C. ribicola* on a native white pine tree near Amery, Wis., September 16, 1919. The puzzling occurrences of this fungus on Ribes late in the season, which had been earlier apparently free from disease, may be explained by the presence of such late aecia.

On the biology of Fomes applanatus, J. H. White (*Roy. Canad. Inst. Trans., 12 (1920), No. 2, pp. 133–174, pls. 6, figs. 2*).—*F. applanatus*, widely distributed and common in North America and Europe, causes decay of large quantities of wood annually, attacking practically all deciduous species and several coniferous tres, both living and dead. This fungus is said to have been now for the first time comprehensively studied. Investigations here noted have followed three main lines, viz, a study of the morphology and the ecology of *F. applanatus* and of its action on the host; a determination of the etiological relationships by culture methods, and a testing of the applicability of such methods to a study of the timber-destroying fungi; and an investigation of the possibility of finding criteria by which to distinguish parasitic action on wood from saprophytic action. Details are given of studies applied to the fungus on wood and in cultures.

F. applanatus has been shown to be a wound parasite, and in southern Ontario at least to be one of the commonest and most destructive of this type. The occurrence of wound gum and the multiplication of tyloses in a band marking the advance of the wood-destroying fungus in a living tree is considered to furnish an unerring criterion for the recognition of the fungus as a parasite. An extensive bibliography is given.

ECONOMIC ZOOLOGY—ENTOMOLOGY.

The "one-letter" rule for generic names in zoology, W. L. McAtee (*Amer. Nat., 55 (1921), No. 636, pp. 89–96*).

Notes on the occurrence of warts on cottontail rabbits, J. E. Guthrie (*Iowa Acad. Sci. Proc., 26 (1919), pp. 157–161, fig. 1*).—This note records the frequent occurrence of epithelial growths on the heads of cottontail rabbits in the western border counties of Iowa and in southern Nebraska.

The migratory bird treaty act (*U. S. Dept. Agr., Dept. Circ. 182 [1921], pp. 3*).—This is an extract from the charge delivered to the grand jury in the District Court of the United States for the Middle District of Alabama at Opelika, April 4, 1921, by Judge H. D. Clayton.

The crow in Michigan: Its status and methods of control, A. C. Conger (*Michigan Sta. Quart. Bul., 3 (1921), No. 3, pp. 108, 109*).—This is a brief summary of the status and methods of control of the crow in Michigan.

The status of Merriam's shrew (Sorex merriami), H. H. T. Jackson (*Jour. Mammalogy, 2 (1921), No. 1, pp. 29–31, fig. 1*).

Observations on the nematode genus Nematodirus, with descriptions of new species, H. G. May (*U. S. Natl. Mus. Proc., 58 (1920), pp. 577–588, pls. 7*).—In the course of investigations of the species of Nematodirus, the author failed to find any clear differences between *N. filicollis* Rud. and *N. spathiger* Raill. Four new species were recognized and are described. A list is given of 20 references to the literature.

Studies on Myxosporidia.—A synopsis of genera and species of Myxosporidia, R. Kudo (*Ill. Biol. Monog., 5 (1919), No. 3–4, pp. 265, pls. 25*).—The author states that the total number of species of Myxosporidia reported to date and described in the present work, excluding 12 ambiguous forms, reaches 237, of which 125 are species which have been observed since 1910. Of these 63 species occur in North America. The genus Wardia of the family Ceratomyxidæ is erected, and 15 species are described as new.

The Myxosporidia are common parasites of fish in various parts of the world. A list showing their geographical distribution, a host list, and a bibliography of 10 pages are included.

The general anatomy and physiology of insects, C. HOULBERT (*Les Insectes; Anatomie et Physiologie Générales. Paris: Libr. Octave Doin, 1920, 2. ed., rev., pp. 374+[XVII], figs. 209*).—A second edition of this work (E. S. R., 24, p. 54) on the anatomy and physiology of insects, which includes a bibliography of 10 pages.

General treatise on entomology, T. MIYAKE (*Konchûgaku Hanron Jôkwan. Tokyo: Shokabo, 1919, vol. 2; rev. in Science, n. ser., 50 (1919), No. 1301, p. 527*).—This second volume of the work previously noted (E. S. R., 38, p. 357) includes a discussion of insects in relation to plants, animals, and man, with methods of general study, classification, and collection. A history of entomology in foreign countries and in the older days in Japan is also included. The review is by L. O. Howard.

Report of the division of entomology, F. SHERMAN and Z. P. METCALF (*North Carolina Sta. Rpt. 1920, pp. 39–45*).—Investigational work during the year is briefly considered by F. Sherman. This is followed by a report of the entomologist, Z. P. Metcalf, of the work carried on under the Hatch and Adams funds.

Experiments in the destruction of suckers in tobacco fields have shown that from 98 to more than 99 per cent of the flea bettles that were thus forced into hibernation before the middle of September died before the tobacco was up in the seed beds the next spring. On the other hand, in a few cases as many as 60 per cent of the beetles which fed on tobacco suckers until frost were able to live through the winter.

Report of the entomological department, C. E. SANBORN (*Oklahoma Sta. Rpt. 1920, pp. 31–46, figs. 17*).—Apicultural work is briefly reported upon, and some of the more important insect enemies of the season of garden, field, and horticultural crops and poultry are noted.

Annual report, division of entomology, E. G. SMYTH (*Porto Rico Dept. Agr. and Labor Sta. Ann. Rpt., 1920, pp. 83–89*).—Experiments in the artificial transmission of cane mottling disease were carried on during the year, in continuation of those of the previous year (E. S. R., 44 p. 159).

Of 266 experiments with insects that had previously fed upon mottled cane, 9 with chewing insects gave negative results. The other 257 tests were with sucking insects, and, of these, 9 gave positive inoculation with the cane mosaic. "Of the 9 plants, 2 became diseased following attack of the West Indian cane-fly (*Stenocranus saccharivorus* Westw.), 1 following attack of the yellow cane aphis (*Sipha flava* Forbes), and 1 following attack of the sugar-cane mealy bug, *Pseudococcus calceolariae* (?). Three plants became diseased in cages containing both cane-fly and yellow aphis, and 2 plants in a cage containing both cane red spider (*Oligonychus viridis* Banks) and the false mottling leafhopper (undetermined). In the case of the last five inoculations it was not possible to fasten the responsibility on a single species of insect. From these figures it is seen that only 3.5 per cent of the tests made with sucking insects were successful, which leaves a considerable margin of doubt in favor of the theory that these insects are the sole carriers of the disease, in view of their comparative scarcity in many cane fields where the disease has been spreading rapidly."

Plant quarantine work is also briefly reported upon.

Entomology (*Ontario Agr. Col. and Expt. Farm Ann. Rpt., 45 (1919), pp. 31–34*).—This is a brief report on the occurrence of the more important insects of the year and means for their control, together with a brief account of spraying experiments.

Fiftieth annual report of the Entomological Society of Ontario, 1919 (*Ent. Soc. Ontario Ann. Rpt., 50 (1919), pp. 136, figs. 20*).—This, the usual annual report (E. S. R., 42, p. 51), includes the following papers presented at the annual meeting: Reports on Insects of the Year: Division No. 3, Toronto District, by A. Cosens (pp. 13, 14), Division No. 4, Peterborough District, by F. J. A. Morris (pp. 14, 15), Division No. 5, Essex District, by J. W. Noble (p. 15); Entomological Progress in British Columbia, by R. C. Treherne (pp. 16–18); Results of Some Preliminary Experiments with Chloropicrin, by G. J. Spencer (pp. 18–21); Our Common Cercopidæ, by G. A. Moore (pp. 21–25); My Experience this Year in Dusting and Spraying (1919), by Father Leopold (pp. 25–30); Insect Outbreaks and their Causes, by J. D. Tothill (pp. 31–33); Further Notes on the Control of Pear Psylla, by W. A. Ross and W. Robinson (pp. 33–38); The Federal Plant Quarantine Act, by C. L. Marlatt (pp. 38–43); Hopkins' Bioclimatic Law, by W. Lochhead (pp. 43–49); Locusts in Manitoba, with Special Reference to the Outbreak in 1919, by N. Criddle (pp. 49–53); Life-history Notes on Some Species of Acrididæ (Orthoptera) found in British Columbia, by E. R. Buckell (pp. 53–61); One Year's Experiments in the Control of the Cabbage Maggot, by W. H. Brittain (pp. 61–68); The Control of the Cabbage Root Maggot in British Columbia, by R. C. Treherne and M. H. Ruhmann (pp. 68–70); Further Data on the Control of the Cabbage Root Maggot in the Ottawa District, by A. Gibson (pp. 71–73); Cabbage Maggot Control, by L. Caesar and H. C. Huckett (pp. 73–77); The Present Status of Mill-infesting Pests in Canada, by E. H. Strickland (pp. 77–80); Some Notes on the Life History of our Common June Beetles, by H. F. Hudson (pp. 81–83); Report of the Insects of the Year, Division No. 6, by H. F. Hudson (pp. 83, 84); The Strawberry Root Weevil in British Columbia, by W. Downes (pp. 84–88); The Strawberry Weevil, by W. A. Ross and C. H. Curran (pp. 88–95); Insects of the Season in Ontario, by W. A. Ross and L. Caesar (pp. 95–104); Remarks on the Ancestry of Insects and their Allies, by G. C. Crampton (pp. 105–110); Later Developments in the European Corn Borer Situation, by E. P. Felt (pp. 110, 111); and The Entomological Record, 1919, by A. Gibson and N. Criddle (pp. 112–134).

[Papers on insects and insect control] (*Min. Agr. [France], Ann. Serv. Épiphyties, 6 (1918), pp. 34–174, 228–280, 289–319, figs. 55*).—Papers here reported (E. S. R., 41, p. 59), which relate to economic entomology, include the following: Insect Enemies of the Fig Tree, by F. Picard (pp. 34–174), the special part of which deals with those which attack the wood and those which attack the foliage; A Chalcidid Injurious to the Almond Tree in the Syrian Region [*Eurytoma amygdali* End.], by P. Lesne (pp. 228–241); The Treatment of Tree Fruits with Arsenicals Alone and with Insecticides and Fungicides Combined, by P. Marchal (pp. 242–280); Locusts in the Southeast of France in 1918, by P. Vayssière (pp. 289–298); Use of the Trap Bait in Combating the Cochylis Moth, by L. Moreau and E. Vinet (pp. 299–312); and Experiments with Delayed Arsenical Treatments for the Control of the Eudemis Moth (*Polychrosis botrana* Schiff.), by F. Feytaud (pp. 313–319).

Report of the Imperial Entomological Conference (*Imp. Ent. Conf. [London] Rpt., 1920, pp. 19*).—This is the report of a conference held at London June 1 to 11, 1920.

Grasshoppers and related insects (*Maine Sta. Doc. 541 (1921), pp. 6*).—This circular briefly summarizes the methods of control of these insects, a more detailed account of which is given in Bulletin 296, previously noted (E. S. R., 45, p. 254).

The screw worm and the wool maggot, O. G. Babcock and D. H. Bennett (*Texas Sta. Circ. 27 (1921), pp. 3–15, figs. 7*).—This is a popular summary of information on the screw worm (pp. 3–14) and the black blow fly or wool maggot, *Phormia regina* Meig. (pp. 14, 15).

Insect injuries in relation to apple grading, B. B. Fulton (*New York State Sta. Bul. 475 (1920), pp. 3–42, pls. 4, figs. 19*).—In this bulletin the species of insects that attack apple fruits are described and grouped according to the character of the injuries they produce. A key is given for the identification of these species, which permits ready recognition of the typical malformations of the fruits. Methods for combating the individual insects are described. The bulletin includes colored plates of some apple insects controlled by spraying and injuries common to apples. Charts are given illustrating periods during which the insects are actively injurious to the fruit and the stages in the development of the buds and fruit when sprays should be applied.

Insect enemies of shade trees and ornamentals, G. A. Dean (*Kans. State Hort. Soc. Bien. Rpt., 35 (1918–19), pp. 151–171*).—This is a summary of information on the more important insect enemies of shade trees and ornamentals in Kansas.

[Insect pests of the oil palm] (*Bul. Imp. Inst. [London], 18 (1920), No. 2, pp. 237–240*).—This is a brief summary of information on the more important insect enemies of *Elaeis guineensis*.

Late developments in arsenical insecticides, R. A. Cooley (*Better Fruit, 15 (1920), No. 5, pp. 9, 10, 16*).—The author reports that crude white arsenic obtained from Montana smelters at a low cost has given quite satisfactory results when used in grasshopper control. It was also found that it could be used as a spray on potatoes for the control of the potato beetle without injuring the foliage, perhaps due in part to the short period of time that the arsenic was in the water, since, when sprayed on the vines, the water evaporated very quickly. The first experiment was with the refined white arsenic, and later the crude product was applied as a dust and the results were even better, due, it is thought, to the fineness of the crude product.

The action of chloropicrin on grain pests, A. Piutti and R. Bernardini (*Rend. Accad. Sci. Fis. e Mat. Napoli, 3. ser., 23 (1917), No. 4–6, pp. 51–53; abs. in Rev. Appl. Ent., 8 (1920), Ser. A, No. 8, p. 334*).—Chloropicrin has been found to be more effective against *Calandra granaria, Tenebroides mauritanicus, Lœmophlœus ferrugineus,* and the larvae of *Sitotroga cerealella, Tinea granella*, and *Plodia americana* than is carbon bisulphid, carbon tetrachlorid, sulphurous anhydrid, hydrocyanic acid, etc.

Grasshopper control work in Iowa, H. E. Jaques (*Iowa Acad. Sci. Proc., 26 (1919), pp. 133–142, figs. 8*).—The author reports upon work with grasshoppers, the attacks by which during the summer of 1918 seemed to have been the most extensive of recent years.

Experiments conducted during the summer of 1919 showed that grasshoppers caught with a hopperdozer with either kerosene or gasoline as a killing agent may be dried even more successfully than those caught alive, and that in feed value they are in every way the equal of those caught without kerosene. A bushel of grasshoppers caught in the hopperdozer, when thoroughly drained, weighs 40 lbs. and contains about 85,340 individual insects. In drying the weight was reduced to about 31 per cent of the original weight, but they expanded enough in bulk to make a bushel weigh only 8 lbs. when thoroughly sun dried

The locust in Argentina, F. Lahille (*Min. Agr. Lab. Zool., Buenos
1920, pp. 172, pls. 12, figs. 16; abs. in Rev. Appl. Ent., 8 (1920),
pp. 475, 476*).—This is an extended account of the locusts occ

tina, including *Schistocerca flavofasciata* DeG., *S. paranensis* Burm., *S. rustica* F. (*pallens* Scud.), and *S. cancellata* Serv.

Locusts and their control (*Bul. Imp. Inst.* [*London*], *18* (*1920*), *No. 2*, *pp. 256–270*).—This is a popular summary of information on the subject.

Thrips damaging tobacco (Anaphothrips striatus Osb.), W. W. FROGGATT (*Agr. Gaz. N. S. Wales*, *31* (*1920*), *No. 7*, *pp. 502–506*, *figs. 2*).—The author records injury by *A. striatus* to tobacco in the Tamworth and Gunnedah districts of New South Wales. The attack of the thrips upon the maturing leaves causes them to dry and results in a considerable reduction in the weight of the infested foliage. The frass deposited all over the surface of the infested leaves also damages the quality of the dried leaf.

The life cycle of aphids and coccids, E. M. PATCH (*Maine Sta. Bul. 295* (*1920*), *pp. 221, 222*).—This is an abstract of the paper previously noted (E. S. R., 45, p. 251).

A descriptive catalogue of the scale insects (Coccidae) of Australia, W. W. FROGGATT (*Agr. Gaz. N. S. Wales*, *25* (*1914*), *Nos. 2*, *pp. 127–136*, *pl. 1*; *4*, *pp. 311–319*, *pl. 1*; *7*, *pp. 599–610*, *pls. 2*; *8*, *pp. 677–684*, *pl. 1*; *10*, *pp. 875–882*, *pl. 1*; *11*, *pp. 983–989*, *pl. 1*; *26* (*1915*), *Nos. 5*, *pp. 411–423*, *pls. 4*; *6*, *pp. 511–516*, *pl. 1*; *7*, *pp. 603–615*, *pls. 3*; *9*, *pp. 754–764*, *pls. 3*; *12*, *pp. 1055–1064*, *pls. 2*; *27* (*1916*), *Nos. 6*, *pp. 425–430*, *pls. 2*; *8*, *pp. 568–578*, *pls. 2*; *11*, *pp. 809–816*, *figs. 5*; *12*, *pp. 883–888*, *fig. 1*; *28* (*1917*), *Nos. 2*, *pp. 134–140*, *figs. 4*; *7*, *pp. 505–514*, *figs. 6*).—This has been noted from another source (E. S. R., 42, p. 453).

The nondiaspine Coccidae of the Philippine Islands, with descriptions of apparently new species, H. MORRISON (*Philippine Jour. Sci.*, *17* (*1920*), *No. 2*, *pp. 147–202*, *pl. 1*, *figs. 40*).—This paper includes descriptions of one new genus and five new species.

On the bionomics and development of Lygocerus testaceimanus Kieff. and L. cameroni Kieff. (Proctotrypoidea-Ceraphronidae), parasites of Aphidius (Braconidae), M. D. HAVILAND (*Quart. Jour. Micros. Sci.* [*London*], *n. ser.*, *65* (*1920*), *No. 257*, *pp. 101–127*, *figs. 18*).—"*L. testaceimanus* is a hyperparasite of *Aphis saliceti* Kalt., through the primary parasite *Aphidius salicis* Hal.; and *L. cameroni* is similarly a hyperparasite of *Macrosiphum urticae* Kalt., through the primary parasite *Aphidius ervi* Hal. The Aphidius is attacked immediately before or after metamorphosis, when lying within the empty skin of the aphis within which it is reared.

"The egg is laid, and post embryonic development takes place, outside the body of the host. The evidence points to the conclusion that there are four larval instars and three moults. The larvae differ in several particulars from those of the families of Proctotrypoidea previously described, and there is considerable difference in form between the early and later instars. During development, which lasts about six days, the larva devours its host, and then pupates within the skin of the aphis for a further period of two weeks. Two and possibly more, broods are reared in the season; and it is probable that the hyperparasite is a considerable check on the Aphidius in its control of plant-lice infestation.

"Lygocerus, though occasionally attacked by its own species, was never found to be parasitized by another hymenopteron. This immunity is probably due to the active movements with which the larva and pupa in the cocoon respond to external stimuli."

A bibliography of 27 titles is included.

k fly on citrus trees, S. F. ASHBY (*Jour. Jamaica Agr. Soc.*, *24* (*1920*), *74; 6–7*, *pp. 182–184*; *abs. in Rev. Appl. Ent.*, *8* (*1920*), *Ser. A*, *81*).—A brief account is given of the occurrence and status of spiny citrus white fly (*Aleurocanthus woglumi*), in Jamaica.

Red and brown fungi appear to slowly follow and attack the pest, and the heavy early infestation is appreciably reduced as the fungi become established. It is said that at the lower elevations ant control is frequently 100 per cent efficient. In colonization work it is necessary to destroy the small black stinging ant by oil emulsion before the establishment of the beneficial ant can be successfully accomplished.

The pink bollworm in the West Indies, H. A. Ballou (*Agr. News [Barbados], 19 (1920), No. 487, pp. 410, 411*).—The pink bollworm was discovered in cotton fields in Montserrat on November 5, 1920, and in St. Kitts on November 15, and investigations have shown it to be well established on both islands. No infestation has been found in Antigua or Nevis. It is thought that the infestation originated on a steamer from Brazil, the cargo of which included some 50 tons of cotton seed from that country. This steamer is said to have called for cargo at St. Kitts, Montserrat, and Antigua in June.

The control of the codling moth in the Arkansas Valley fruit belt, G. A. Dean and W. R. Martin (*Kans. State Hort. Soc. Bien. Rpt., 35 (1918–19), pp. 89–102, figs. 6*).—This account is accompanied by charts which show the time and extent of the damage by the codling moth.

Spraying apples and pears for control of codling moth, T. D. Urbahns (*Calif. Dept. Agr. [Pamphlet], 1920, pp. 3*).—Directions are given for the application of insecticides for the control of the codling moth in California.

The corn ear worm, J. W. McColloch (*Canner, 52 (1921), No. 6, pp. 37–40*).—This is a paper presented before a meeting of the Western Canners' Association at Chicago, in November, 1920.

Biology and economic importance of Anastatus semiflavidus Gah., a recently described egg parasite of Hemileuca oliviae, D. J. Caffrey (*Jour. Agr. Research [U. S.], 21 (1921), No. 6, pp. 373–384, pl. 1, figs. 3*).—This parasite of the New Mexico range caterpillar, *H. oliviae* Ckll. (E. S. R., 23, p. 463) appears to have been reduced by some severe and unusual climatic condition to such an extent that its presence was not discovered prior to 1913. Since this time it has increased in numbers each year until it now exerts a powerful influence in the natural control of its host. The parasite has been found to be widely distributed in that part of northeastern New Mexico which was heavily infested by the range caterpillar.

Oviposition begins as soon as the eggs of its host are deposited or about the middle of September, and continues until the arrival of severe winter weather, which occurs at these high altitudes during late November or early December. Judging from numerous dissections of host eggs, it is probable that the parasite eggs which are deposited just before the beginning of cold weather hibernate in that stage, while the eggs which are deposited early in the season hatch and hibernate as partly developed larvae within their host.

The larval period of individuals observed was limited to about seven months, whereas other eggs in the same egg clusters were found to contain full-grown dormant larvae nearly two years later. Dissections of 1- and 2-year-old eggs collected in the field gave similar results, and established the fact that on some occasions the insect remains in a dormant larval state for at least two years.

The pupal period appears to be very short. Adults have been observed in the field from the early part of May until the first of December, the maximum emergence occurring during July and August.

"From a series of 49 cages started in September and October, 1914, a total of 383 adults were reared. These adults required a maximum of 449 days and a minimum of 226 days to complete their life cycle, the average being 380 days. From a series of cages started in October, 1915, a total of 40 adults were reared. These adults required a maximum of 346 days and a minimum of 238 days to complete their life cycle, the average being 266 days. From a series of stock cages started the last week in September, 1914, adults were reared from the first week in the following May until March, 1917, a minimum of 7 months and a maximum of 30 months. It is evident that this prolonged life cycle was not due to the artificial cage conditions, because adults emerged from 1- and 2-year-old eggs collected in the field."

The methods of rearing in cages and the habits of the parasite are considered at some length. Adults of *A. semiflavidus* were also reared from eggs of *H. nevadensis* Stretch. Laboratory experiments demonstrated that adults emerging from *H. oliviae* eggs would breed in eggs of *H. nevadensis*. A study of the life history of *H. nevadensis* demonstrated that its life cycle and that of *H. oliviae* correlate very closely.

The life history and habits of two parasites of blowflies, A. M. Altson and H. M. Lefroy (*Zool. Soc. London Proc., 1920, III, pp. 195–243 figs. 20*).—"The breeding operations and accumulation of supplies of *Alysia manducator* Panz. and *Nasonia brevicornis* Ashm. commenced in July and ceased in December, 1919.

"*A. manducator* oviposits in the larvæ of several carrion-feeding Diptera. Only one parasite emerges from each host puparia. Over-parasitism kills the larva. The mean average of the life cycle is 52 days, and as short as 25. Both sexes are capable of sustained flight, and lived over a month in captivity. Average percentage of parasitism over three years was 43 per cent, observed by Graham-Smith [E. S. R., 42, p. 361]. Average contents of ovaries 366 eggs for 12 females.

"*N. brevicornis* oviposits in the puparia of several species of stercoral and carrion-feeding dipterous larvæ. From 1 to 62 individuals have been found in single puparia parasitized in captivity. The length of the life cycle ranges from 11 to 22.5 days in different countries. Only the female can fly, and then only very short distances, and can live while ovipositing from 4 to 6 weeks, but for a considerably less period without host puparia. The male remains near the vicinity of emergence, where its life is spent in fighting and mating. Average progeny in the case of five females, observed by Girault and Sanders [E. S. R., 23, p. 161] and McCarthy, was 113 per female, and affecting on the average only 16.4 hosts.

"Nasonia can act as an accidental secondary parasite upon *A. manducator* if and when puparia containing the latter are within its limited reach. Both parasites in their hibernating stage, i. e., full-grown larvæ, can successfully withstand over 6 weeks at 2° C. *A. manducator* appears to be a more important parasite as a natural control for the blowfly than *N. brevicornis*, which appears to be more effective as a natural control of Diptera which constantly breed in permanent refuse and garbage heaps, and where hosts would be within crawling distance, such as primarily the common house fly (*Musca domestica*)."

Hessian fly prevention: Entomological service to the Ohio farm bureaus, H. A. Gossard and T. H. Parks (*Ohio Sta. Mo. Bul., 6 (1921), No. 5–6, pp. 67–76*).—The authors report upon the preliminary work of 1919, and the result of the late-sowing campaign of these years, the methods of discovering the seeding date, and October egg laying. See also a previous note (E. S. R., 35, p. 899).

Dusting cotton for the control of the boll weevil, M. C. Tanquary and H. J. Reinhard (*Texas Sta. Circ. 29 (1921), pp. 3–9, fig. 1*).—This is a report of experiments conducted during the season 1920, one with hand guns and two with a large traction duster.

The experiments with the traction duster show that weevil infestation may be reduced from a high to a very low percentage by dusting with calcium arsenate if applied with efficient machinery. Four applications were made between July 17 and August 4 in one of the experiments and four between July 19 and Aug. 9 in the other. In the two dusted plats in the first of the two experiments the percentage of infestation was reduced from 67 to 15.2 per cent and from 24.6 to 11 per cent, respectively; while the infestation in the check plats increased from 59.6 to 75.2 per cent in one, decreased from 52 to 47.6 per cent in another, and increased from 19.2 to 56.6 per cent in the third. In the dusted plat in the second experiment infestation was reduced from 41.2 to 16.4 per cent, while the check plats showed increases of from 58.4 to 73.2 per cent and from 34.2 to 63.8 per cent, respectively. It is pointed out that the dusting should be commenced before a high percentage of infestation is reached, or when the infestation is from 10 to 20 per cent.

Find good remedy for cucumber beetle (*Ohio Sta. Mo. Bul., 6 (1921), No. 5–6, p. 92*).—Tests made at the Marietta field laboratory show a mixture composed of 1 part of calcium arsenate and 20 parts of land plaster, applied with a shaker, to be superior to 25 other materials and compounds tested for control of the striped cucumber beetle. Applications should be commenced as soon as young plants come up, followed by 2 applications per week during fair weather, 10 to 12 applications per season usually being required.

The New Zealand grass grub.—Some notes on its control, A. H. Cockayne (*New Zeal. Jour. Agr., 21 (1920), No. 1, pp. 1–5, fig. 1*).—These notes relate to the control of *Odontria zealandica*.

New serphidoid, cynipoid, and chalcidoid Hymenoptera, A. A. Girault (*U. S. Nat. Mus. Proc., 58 (1920), No. 2332, pp. 177–216*).—Among the new forms here described that are of economic importance are the following: *Hadronotus ajax*, reared from eggs of the squash bug at Baton Rouge, La., and known to occur in Missouri and Texas; *Paraceraptrocerus africanus*, reared from a Ceroplastes on *Elytropappus rhinoceratis*, Cape of Good Hope, Africa; *Achrysopophagus io* and *A. rex*, both reared from the citrus mealy bug on bamboo, Manila, P. I.; *Blastothrix brittanica*, from *Lecanium capreae*, Cheshire, Eng.; *Achrysocharis camilli*, reared from an Agromyza on alfalfa, Elk Point, S. Dak.; *Eurytoma phoebus*, reared from *Elymus canadensis* May, Elk Point, S. Dak.; *Eurytoma poloni*, reared from the larvae of an Agromyza in bean roots, Los Baños, Luzon, P. I., reference to which was made by Otanes y Quesales (E. S. R., 40, p. 457); *Eurytoma illinoisensis*, reared from Elymus, Taber, S. Dak.; *Decatoma flamminneiventris*, parasitic upon *Prodoxus decipiens*, Fort Collins, Colo.; *Paratrigonogastra stella*, reared from Agromyza larva on bean roots, Los Baños, Luzon, P. I.; *Tripolycystus cryptognathae*, reared from the pupa of *Cryptognatha nodiceps* Mskl., Trinidad; *Spalangia muscidarum texensis*, a parasite of the stable fly at Dallas, Tex.; and *Terobia flora*, reared from fig, Cocoanut Grove, Fla. The genera erected are Paraceraptrocerus and Tyndarichoides.

North American ichneumon flies, new and described, with taxonomic and nomenclatorial notes, R. A. Cushman (*U. S. Natl. Mus. Proc., 58 (1920), pp. 251–292, fig. 1*).—This paper includes corrections to Viereck's Type Species of the Genera of Ichneumon Flies (E. S. R., 30, p. 661), and extensive additions to the author's revision of the tribe Cremastini (E. S. R., 38, p. 660), together with descriptions of one new genus, one new subgenus, and 23 new species of Ichneumonidae, and three new species of Braconidae. Among the new species known to be of economic importance are *Spilocryptus propodeum* from *Polychrosis viteana* Clemens, North East, Pa.; *Angitia galleriae*, reared from the bee moth at Lansing, Mich.; *Bassus acrobasidis*, reared from *Acro-*

basis caryaevorella on pecan at Brownwood, Tex.; and *Orgilus gelechiaevora* from *Gelechia trialbamaculella* Chambers at Whitesbog, N. J. The genus Oligotmema and the subgenus Areolpristomerus are erected.

Life-history studies of three jointworm parasites, W. J. Phillips and F. W. Poos (*Jour. Agr. Research [U. S.], 21 (1921), No. 6, pp. 405–426, pls. 6, figs. 16*).—Life-history studies of three of the more important parasites of *Harmolita tritici* Fitch, conducted at the laboratory at Charlottesville, Va., during the years 1917–1919, are reported upon. The species are *Ditropinotus aureoviridis* Cwfd. and *Homoporus chalcidiphagus* Walsh and Riley, both primary parasites, and *Eupelmus allynii* French, a primary and secondary parasite. The distribution of the first two mentioned is similar to that of the jointworm, while *E. allynii* is commonly found wherever the Hessian fly and the majority of the species of Harmolita are found, which includes practically all of the wheat-growing regions of the United States.

D. aureoviridis, first described in 1907, apparently prefers *H. tritici* and *H. vaginicola* Doa., and has been reared by the authors in cell slides on *H. elymicola* P. and E. and *H. grandis* Riley. It breeds freely upon the larvae of *Eurytoma* spp. in the field and in breeding cages, and upon one occasion an egg was deposited in a Harmolita cell upon a pupa of *D. aureoviridis*. Its eggs are deposited in the gall-like cells of *H. tritici* external to the host larva, the period of incubation of 199 eggs in cell slides varying from 1 to 5.5, with an average of 3 days. The largest number of eggs secured from a single female was 18 during a period of 12 days. Larvae reared in glass cells became full grown in from 6 to 24 days, with an average for 137 of 11 days. The prepupal period varied from 1 to 6, with an average of 2 days. The pupal stage varied from 8 to 15, with an average for 8 individuals of 10 days. The winter is passed as full-grown larvae in the jointworm cells in old wheat stubble. In Virginia the adults of the first generation begin to emerge about the first week in June and the second generation about the first week in July. Two complete and a partial third generation were reared in glass cells during 1918 and 1919, and apparently a partial third from the field in 1919.

H. chalcidiphagus, next to *D. aureoviridis*, is the most important parasite of *H. tritici* in Michigan, Illinois, Indiana, Ohio, Kentucky, Tennessee, and Missouri, while in the Atlantic States *Eurytoma* sp. is probably of greater importance. *H. chalcidiphagus*, first described in 1869, is one of the oldest recorded parasites of the jointworm. It has been reared from field collections of *H. tritici*, *H. caginicola*, *H. secalis*, *H. hordei* Har., *H. elymicola*, and *H. atlantica*. The length of the egg stage varied from 1 to 4.5 days, with an average for 71 eggs observed of about 2.5 days. The average number of eggs deposited by 5 females was 31.8 in an average period of 15.2 days. Observations of 42 larvae in glass cells show from 5 to 25 days, with an average of about 11 days, to be required for their development during the summer. The winter is passed as full-grown larvae in the cells of the jointworm. Observations of 37 individuals showed a variation of from 1 to 6 days in the prepupal stage, with an average of about 2 days. The length of the pupal stage for 64 individuals varied from 9 to 10 days. Five complete generations were reared at the laboratory in cell slides from May to September, 1918.

E. allynii was first described in 1882, and its life history was recorded by Packard in 1916 (E. S. R., 35, p. 466). The author considers it to rank about fourth in importance in the list of parasites of *H. tritici*. It apparently breeds as freely as a secondary parasite in jointworm cells as upon jointworms themselves under both field and cage conditions. It has been found breeding as a secondary parasite on *D. aureoviridis*, *H. chalcidiphagus*, and *Eurytoma* sp.

both in cages and in the field. It is recorded from *H. tritici*, *H. vaginicola*, *H. maculata* Hwd., *H. elymicola*, *H. elymivora*, *H. atlantica*, *H. albomaculata* Ashm., *H. grandis grandis*, and from what is thought to be a new species which forms galls in *Panicum clandestinum*, also probably from *H. occidentalis* P. and E. and *H. hesperus* P. and E. The incubation period of 79 eggs varied from 1 to 4.5 days, with an average of 2.4 days. From 7 to 12 with an average of 9 days were required for the development of 32 larvae reared in glass cells in 1918. They were found to breed freely in cell slides through five generations during the season of 1918. The prepupal stage varied from 1 to 3 with an average of 1.7 days for 17 individuals, and the pupal stage from 7 to 33 with an average of 21 days for 62 individuals. One female observed lived 52 days and oviposited over a period of 32 days. Four generations were reared in glass cell slides during the breeding season of 1918, starting with females that emerged from material collected the previous fall and kept under as nearly normal conditions as possible.

"Judging from the observations recorded herewith and from the field observations of the season of 1919, it is quite clear why the parasites do not quickly gain complete control of the wheat jointworm. The writers have found that as the parasites become more abundant hyperparasitism increases greatly. Some of the parasites that are primary only, when present in small numbers, become both primary and secondary as they become more abundant."

The auditory sense of the honeybee, N. E. McIndoo (*Abs. in Anat. Rec., 20 (1921), No. 2, pp. 182, 183*).

The olfactory sense of the honeybee as related to pollination, K. von Frisch (*Zool. Jahrb., Abt. Allg. Zool. u. Physiol. Tiere, 37 (1919), No. 1–2, pp. 238, figs. 14*).—This is an extended report of investigations. It includes a bibliography of 105 titles, and author and subject indexes.

Sixty years of beekeeping in California, J. E. Pleasants (*Calif. Cult., 56 (1921), No. 5, p. 133*).—This is an account by one of the pioneer beekeepers in California.

The Dadant system of beekeeping, C. P. Dadant (*Hamilton, Ill.: Amer. Bee Jour., 1920, pp. X+115, figs. 59*).—The chapters of this work relate to early experiments and natural history, size of hives, drones and drone production, the Dadant hive, handling bees, apiaries, apiary management in the spring, swarm prevention and supering, extracting the honey, nomadic beekeeping, fall management, wintering, diseases of bees, and enemies of bees.

Preliminary notes on the value of winter protection for bees, J. H. Merrill (*Kans. State Hort. Soc. Bien. Rpt., 35 (1918–19), pp. 119–129, figs. 5*).—This is a report upon work conducted with a view to securing data showing the necessity for winter protection.

Six hives containing a known amount of honey and a known number of bees were placed on scales and daily readings taken of all changes in weight. Three of these hives were sheltered by a windbreak while the others were not. Each set of three consisted of one 1-story hive, one 2-story hive, and one packed hive. In addition to making daily readings of the changes in weights, a general weighing was made at the beginning of the honey flow in the spring to determine the number of bees in the colonies on that date.

"These observations show that the 2-story hive is preferable to the 1-story hive, and the packed hive is much to be preferred over the unpacked hive. It was also shown that a windbreak is very essential, especially to colonies which have no other form of winter protection. The effect of a severe winter was found to be less injurious to the overwintering of bees than an open winter. Colonies which are packed for the winter consume more stores, owing to the fact that more stores are necessary, due to increased brood rearing."

How to control American foulbrood, H. F. Wilson (*Wisconsin Sta. Bul. 333 (1921), pp. 21, figs. 8*).—This is a summary of information, giving directions for combating this disease of the honeybee.

FOODS—HUMAN NUTRITION.

The microbiology and microanalysis of foods, A. Schneider (*Philadelphia: P. Blakiston's Son & Co., 1920, pp. X+262, figs. 131*).—As indicated by the title, this volume is concerned with the theoretical and practical aspects of the microbiology of foods. The first five chapters are devoted to a discussion of the decomposition changes occurring in foods, the principal groups of organisms concerned in food spoilage, and the kinds of food most and least likely to undergo microbial deterioration. The next five chapters contain general and special directions for the microanalytical investigation of food products, proposed food ratings based upon the author's experience in the examination of food products, and the legal standards of purity for animal and vegetable products, salt, and alimentary pastes. A diet table, compiled by G. T. Sipes, and a list of 14 reference books complete the volume.

The book for all households, or the art of preserving animal and vegetable substances for many years, N. Appert, trans. by K. G. Bitting (*Chicago: Glass Container Assoc. Amer., 1920, pp. 18+XV+113, figs. 7*).—This is a translation of the original description by Appert of his process of preserving foods through sterilization by heat in closed vessels, the process which is the foundation of the modern methods of canning.

Although developed more than 100 years ago, the directions read surprisingly like those of the modern method of cold pack canning. The general principle, as described in the author's words, is "to enclose in the bottle or jar the substances that one wishes to preserve; to cork these different vessels with the greatest care, because success depends chiefly on the closing; to submit these substances thus enclosed to the action of boiling water in a water bath for more or less time according to their nature and in the manner that I shall indicate for each kind of food; and to remove the bottles from the water bath at the time prescribed."

Among the suggestions and precautions are to be noted the poor economy in using cheap corks (the bottles were sealed by forcing well-softened corks into the neck of the bottle with a mallet); the necessity of using fresh, well selected material and of grading it according to size; and the indispensability of speed and cleanliness in the preparation of the materials. In the special directions for individual vegetables the process of blanching is generally prescribed as shown by the following directions for artichokes: "After having removed all the unnecessary leaves, and pared them, they are plunged into boiling water, and then into cold water; after they have drained, they are put in wide-mouthed bottles, closed, etc., and then in the water bath to receive an hour's boiling, etc."

Of interest and possible present-day application is the use of cloth bags for holding the separate jars during sterilization. The bags, which are lowered into the water bath by string handles, are said not only to protect the jars against breakage, but in the event of breakage from defective glass, the fragments of glass remain in the bags.

In the preserving of fruits the author recommends using no sugar but sweetening the finished product when served with a grape sirup prepared by boiling down grape juice and treating it with chalk or washed ashes to neutralize its acidity. The resulting sirup is considered to preserve the aroma and acidity of the fruits better than sugar. Jams and conserves are prepared by boiling down the sterilized fruit with the sirup.

A brief sketch of the life of Appert and translations of the correspondence at the time of the adoption of this method in France are included.

The effect of certain agents on the development of some molds, K. G. Bitting (*[Chicago]: Glass Container Assoc. Amer., 1920, pp. 177, figs. 179*).—This is the report of an extensive series of microscopic studies of the effect of various agents found naturally in or frequently added to foods upon the growth of three molds, *Penicillium expansum, Alternaria solani,* and *Oidium lactis,* all of which were isolated from tomato products and grown under uniform conditions in tomato bouillon, to which were added the various materials to be tested. The data reported include a set of tables giving the number of days required for germination and the macroscopic developmental features of the growths in the flasks at intervals of 24 hours for the first 5 days, and another set which records the average size and the microscopical appearance of the conidia of the Penicillium after germination. The descriptions are supplemented by microphotographs of the three molds under the varying conditions of the experiment.

The oldest and most generally used preservatives, salt, sugar, and potassium nitrate, produced plasmolysis, resulting finally in the complete arrest of growth from starvation but not in the death of the organism. Most of the spices tested were innocuous, causing neither retardation nor abnormal effects. Allspice, cinnamon, and cloves produced varying degrees of enlargement with disorganization of the protoplasm and walls. Mustard produced starvation and disorganization of the protoplasm and in the Penicillium a tendency to form fruity heads almost directly from the hyphae developed from the germinated spore. This was noted even when minute amounts of the mustard were used.

Citric, lactic, and malic acids in amounts up to 6 per cent caused only a slight retardation in development, tartaric a somewhat greater retardation, and acetic, benzoic, boric, butyric, and salicylic acids and their sodium salts a complete disorganization of both protoplasm and walls.

Metallic salts produced similar though not so extreme results. Swelling by the lesser amounts and stunting by the greater were produced by carbolic and the mineral acids, creosote, mercuric chlorid, and the alkaloids, the last two also causing disorganization of the protoplasm. Alcohol retarded development and produced swelling, distortion, and hardening, and in some cases disorganization.

An extensive list of literature references is appended.

The nutritive value of some preserved foods, J. Athanasiu, G. Pamfil, and P. Stavresco (*Compt. Rend. Soc. Biol. [Paris], 83 (1920), No. 14, pp. 568–571, fig. 1*).—This is a condensed report of the results of digestion experiments, conducted on 10 young men, using various rations employed in the Rumanian Army. These included the customary barracks ration of fresh meat, vegetables, and bread; canned meat and biscuits (galettes); canned white beans and galettes; roast meat and bread; vegetable soup and bread; the barracks ration with polenta in place of bread; vegetable soup and polenta; cold storage meat and bread; and white cheese and galettes. Data are presented on the protein content of the different rations, the coefficients of digestibility of the protein of the different rations, the urinary nitrogen, the content of starch, the content of salts, the salts eliminated, and the chlorids eliminated. The principal conclusions drawn are that the proteins of white beans and corn are more difficult to digest than those of bread and meat, that the starch of the white beans and corn are more difficult to digest than those of bread and other vegetables, that canned meat is more difficult to digest than boiled or roasted meat, and that the nitrogen balance is lowest on feeding with white beans and with polenta in place of bread.

The chemical properties of food fats of different biological values, S. Rosenbaum (*Biochem. Ztschr., 109 (1920), pp. 271–278*).—In an effort to determine a possible relationship between the composition of food fats and their biological value, determinations of phosphatids and sterols were made in egg yolk fat, cod liver oil, butter fat, human milk fat, lard, and hazel nut oil. No quantitative differences could be found which could be correlated with differences in biological value.

Experiments on leavening bread, J. Grossfeld (*Chem. Ztg., 44 (1920), No. 143, pp. 889, 890*).—As the result of various attempts to obtain a substitute for yeast which would have satisfactory leavening powers without using up the nutrients in the flour as does yeast, and which would not give the bread the objectionable taste often resulting from the use of soda, the author suggests a combination of equal parts of sodium bicarbonate and calcium carbonate with sour milk as a source of lactic acid. The sour milk is used instead of sweet milk or water to form the dough, and to the dough is added during kneading a mixture of equal parts of the two salts in the proportion of 14 gm. to 1 liter of the sour milk. The reactions involved consist in the evolution of CO_2 by the action of the lactic acid on the sodium carbonate and the removal of the excess of acid by union with the calcium carbonate, forming calcium lactate which does not have the disagreeable taste imparted to the bread by excess of sodium carbonate.

Note on the influence of diet on the energy expenditure in work, J. B. Orr and J. P. Kinloch (*Jour. Roy. Army Med. Corps, 36 (1921), No. 2, pp. 81–86*).—To determine whether the amount of energy expended per unit of work is influenced by the nature of the preceding meal, the resting metabolism and the energy expenditure on a constant amount of work were determined upon a single subject in the postabsorptive state immediately before a meal (15 hours after the last meal) and after an interval of 90 minutes following meals in which protein, fat, and carbohydrate, respectively, predominated. The test meals consisted of 50 gm. of oatmeal, with additions of 100 gm. plasmon (about 80 per cent casein), 80 gm. of cane sugar, and 35 gm. of margarin for the high protein, sugar, and fat diets, respectively. The protein and carbohydrate meals furnished about 540 calories and the fat about 480 calories each. The work consisted in marching along a corridor at the rate of 100 yds. a minute. The energy expenditure was measured by indirect calorimetry. The increase in net expenditure on work in calories per minute was found to be for the protein meals 3.86 in the post absorptive state and 3.96 after meals, for carbohydrate 3.71 and 3.65, and for fat 3.77 and 3.77, respectively.

These results show that the expenditure of energy per unit of work performed is influenced by the nature of the preceding meal. Following the high protein meal, the increase due to work is greater and following a high carbohydrate meal less than in the preceding post absorptive state, while following a high fat meal the extra energy expenditure due to food is equal to that due to work. While it is suggested that the difference in results obtained in these three cases is due to a difference in the mechanism of stimulation involved by the ingestion of protein, carbohydrate, and fat, it is pointed out the results are not comparable with those obtained at a different period relative to ingestion of food or after a longer period of work.

Artificial nutrition and vitamins, F. Röhmann (*Über Künstliche Ernährung und Vitamine. Berlin: Borntraeger Bros, 1916, pp. V+150, pls. 2, figs. 19*).—This monograph, which is one of the series of biochemical studies edited by A. Kanitz, is of historic interest in that the author as late as 1916 refused to believe in the existence of vitamins. In addition to reports of original investigations which are considered to prove that mice can be successfully nourished on a diet of purified foodstuffs, a rather extensive digest of vitamin literature is presented, together with arguments attempting to disprove the vitamin theory in each case. The explanation given throughout is that the materials furnishing the so-called vitamins were instead furnishing supplementary materials (Ergänzungsstoffe) for the incomplete proteins of the purified food material. As illustration the proteins of polished rice are considered incomplete, while the silver skin contains "Ergänzungsstoffe," evidently assumed to be of the nature of unknown amino acids, which, when combined with the protein of the polished rice, render it complete. An extensive list of literature references is given as footnotes.

Nutrition experiments (*Oklahoma Sta. Rpt. 1920, p. 31*).—When young rats were fed various rations, the lot receiving wheat, potatoes, and milk made better gains the first 30 days than any lot not fed milk except the lot fed cheese alone. During the next 30 days, the lot receiving cheese showed the largest gain in weight, followed by the oatless group and the wheatless group.

In another test, rats receiving potatoes, salt pork, and water, supplemented by wheat bread and oatmeal, made an average gain in weight in 30 days of 20.4 gm., while a lot receiving corn meal as a supplement gained 14.8 gm. Corresponding lots also receiving milk gained 44 and 44.5 gm.

Lower vegetative forms and the accessory factors of growth, P. Goy (*Compt. Rend. Acad. Sci.* [*Paris*], *172* (*1921*), *No. 4, pp. 242–244*).—From a study, the details of which are not presented, of the food requirements of a number of unicellular organisms including *Saccharomyces cerevisiae*, *Mucor mucedo*, *Aspergillus niger*, *Penicillium glaucum*, *Bacillus megathorium*, and several other organisms, the author states that these lower vegetable forms do not require for their development any organic substances of the nature of the so-called vitamins, but that their proliferation is remarkably stimulated by the addition of a small amount of an inorganic medium in which has formerly been grown either an identical or different species. The organic substance conferring this property has been extracted by means of ether in a crystallizable form from a culture of Mucor. It does not show its growth-promoting property until it has been heated at from 85 to 90° C. and loses it at 168 to 170° dry heat, but is not affected by heating in the autoclave for 1.5 hours at 130°. The substance is further described as containing carbon, possessing acid properties, melting at 175°, not precipitating with phosphotungstic acid, presenting none of the characteristics of an amino acid, and showing no trace of phosphorus or nitrogen. Similar results have been obtained from extracts of vegetable tissues and lemon and orange juice.

The properties upon which the conclusion is drawn that the new substance is not of the nature of the hitherto recognized vitamins are summarized as the need of previous heating to render the substance active, nondestruction by moist heat even at a high temperature, and the presence of the substance in the grains of polished rice. On the other hand the small amount of material necessary, its destruction by radium and by boiling in alkaline solution, its resistance to ultraviolet light, and its truly accessory character point to its being a growth-promoting substance not indispensable to the life of unicellular organisms but singularly efficacious for their proliferation.

The effects of yeast vitamin water-soluble B on plant cell masses and on biocolloids, D. T. MacDougal (*Soc. Expt. Biol. and Med. Proc., 18* (*1920*), *No. 3, pp. 85–87*).—The action of the water-soluble vitamin in yeast upon the hydration of various plant materials is reported. Sections of the materials were placed in slender dishes into which the solutions were poured. The swelling in a vitamin solution prepared by diluting 1 part of yeast in 1,000 of distilled water was compared with that in distilled water alone, using the auxograph in taking the measurements. Various colloidal preparations were also hydrated in the vitamin solution, and the swellings at 15° C., relative to that in water taken as 100 are reported.

The vitamin solution at an H-ion concentration of pH=5.25 caused hydration in excess of that in water with agar, agar and soap, agar-gelatin, agar-gelatin and salts in various proportions, and gelatin, and lessened hydration in agar and salts, agar-gelatin and soap, gelatin and salts, and gelatin and soaps. The vitamin solution caused excess hydration with mature fruits, pith and joints of plants, and dried cell masses of roots and joints of Opuntia, and lessened hydration in young tubers of potato and roots of corn. Increased hydration took place in root-tips of orange seedlings and of strawberry plants. It is suggested that the accelerating action of this vitamin on such unlike colloids may be due to the action of various components inert to each other, and which affect but one of the main components of the biocolloids of the mixtures or of living matter.

Food accessory factors in relation to the teeth and bones, P. R. Howe (*Commonhealth* [*Mass. Dept. Pub. Health*], *7* (*1920*), *No. 4, pp. 228–234, figs. 5*).—The author reports that he has obtained marked changes in the teeth, the alveolar processes, and the jaws of guinea pigs by prolonged feeding on vitamin-deficient diets, consisting of rolled oats supplemented by 25 cc. of fat-free milk daily. The desire being to produce a chronic condition, the animals were carefully watched, and when difficulty in the use of their legs or difficulty in eating was observed, orange juice or a small amount of green food was given until a decided improvement in condition was noted, when the animals were again put back on the vitamin-deficient diet.

In experiments continuing for some time the teeth, particularly in young animals, were regularly decalcified, and distinct cavity formation appeared in some cases. Irregular arrangements of the teeth were common, and many loosened and dropped out. Other decalcified areas occurred in the maxillary bones and in the bones of the head and ribs and leg bones. By alternating deficient and normal diets distinct marking of the enamel of the teeth resulted. These observations confirm the work of Mellanby on young dogs (E. S. R., 41, p. 364) and Zilva and Wells on guinea pigs (E. S. R., 41, p. 471) as to the effect of vitamin-deficient diets on the teeth, and give further emphasis to the belief that tooth destruction is one of the first signs of lack of vitamins in the diet.

The antiscorbutic property of raw, dried, and cooked apples and bananas, M. H. Givens, H. B. McClugage, and E. G. Van Horne (*Soc. Expt. Biol. and Med. Proc., 18* (*1921*), *No. 5, pp. 140, 141*).—The authors report that a per diem dose of 10 gm. of raw applies or bananas will protect a guinea pig against scurvy for 3 months, while protection is not secured by an equivalent amount of these fruits cooked at 100° C. for 15 minutes, or dried at 55 to 60°, or dried at 55 to 60° and cooked for 15 minutes at 100°.

The destructive effect of oxidation on antiscorbutic vitamin, A. F. Hess and L. J. Unger (*Soc. Expt. Biol. and Med. Proc., 18* (*1921*), *No. 5, p. 143*).—As evidence that the antiscorbutic vitamin is destroyed by oxidation, the authors cite the following experiments:

Guinea pigs developed scurvy in from 3 to 4 weeks when fed oats+80 cc. daily of raw milk which had been treated by allowing it to stand over night in the incubator after adding normal hydrogen peroxid solution in the proportion of 4 cc. to 1 liter of the milk. Orange juice added to the dietary served as a protective or curative agent. It is also noted that orange juice subjected to oxygen for a short period and milk or tomato juice which had been shaken lost some of this vitamin.

"As foodstuffs undergo oxidative processes frequently in the course of various manipulations, no doubt this factor plays an important rôle. This action probably explains the differences in the antiscorbutic potency of foodstuffs which have been treated in apparently similar ways, for example, of milk which has been heated in open pans or in hermetically sealed bottles."

Regeneration of the testicle in the pigeon deprived of vitamins, P. Portier (*Compt. Rend. Acad. Sci. [Paris], 170 (1920), No. 22, pp. 1339–1341*).—In continuation of the study of the effect of deprivation of vitamins on the testicles of pigeons (E. S. R., 43, p. 369), the author reports that birds whose right testicles have been partially removed while on a vitamin-free diet are able to regenerate the testicle to normal size and activity on being fed for some time on a vitamin-rich diet. It is thought that the successive lack and abundance of vitamins play an important rôle in the phenomenon, as the regeneration of the function of the testicle took place in the winter when in the normal pigeon the organ would be in its seasonal involution.

The mechanism of the lesions and the physiological symptoms presented by animals suffering from deficiency diseases, H. Bierry, P. Portier, and L. Randoin-Fandard (*Compt. Rend. Soc. Biol. [Paris], 83 (1920), No. 19, pp. 845–847*).—The authors attempt to establish a causal relationship among the different pathological changes observed in cases of avitaminosis, including hypertrophy of the adrenals, atrophy of the majority of the other organs, and lowering of the temperature preceding death.

In interpreting these facts three phases of avitaminosis are noted, as follows: In the first phase, where no symptoms are evident, the animal is consuming its vitamin reserves. In the second phase the animal reacts by hypertrophy of the adrenals and hypersecretion of adrenalin. This results in sclerotic lesions which start in the vesicular system and branch out into the parenchyma. At the same time that the living cells absorbed by the regions of sclerosis furnish the organisms with vitamins, the field of metabolism is restricted more and more. During the third and last phase the adrenal glands become incapable of furnishing the organism with a sufficient quantity of adrenalin, and a marked lowering of the temperature results.

Observations on beriberi among the Chinese in France, A. R. Leggate (*Edinb. Med. Jour., n. ser., 24 (1920), pp. 32–36*).—Observations on 269 cases of beriberi in the Chinese general hospital in France in 1917 are reported which present striking evidence of the intimate associaton of berberi with a diet of polished rice.

Scurvy in North Russia, J. D. Comrie (*Edinb. Med. Jour., n. ser., 24 (1920), pp. 207–215, pl. 1*).—This is an account of the epidemic of scurvy in North Russia previously noted from a report by Stevenson (E. S. R., 44, p. 262).

The possible pathogenicity of Bacillus botulinus, R. B. Edmondson, L. T. Giltner, and C. Thom (*Arch. Int. Med., 26 (1920), No. 3, pp. 357–366*).—In six series of experiments, involving from 3 to 6 guinea pigs each, typical botulism was induced in every case where heated spores of the Boise strain were injected subcutaneously with small amounts (from 0.5 to 1 cc.) of a 2 per cent $CaCl_2$ solution. All but 2 of the control animals receiving spores only died of botulism, but after a somewhat longer interval. The deaths occurred in from 3 to 6 days when the spores and salt were injected at the same time, and somewhat later if an interval occurred between the two injections. The Nevin strain gave almost negative results, only 1 out of the 4 animals dying. In several of the cases living virulent bacilli were isolated from the local lesions at the site of injection.

Toxin-free spores of both the Boise and Nevin strains were fed to guinea pigs in small and large doses. With the Boise strain small doses of the heated spores produced no effect, and large doses caused botulism. With the Nevin strain 1 only of the 7 animals died of botulism.

These results are thought to indicate a limited and irregular pathogenicity of the organism itself, and point to the necessity of destroying all foods suspected of containing *B. botulinus* instead of salvaging them through heat.

ANIMAL PRODUCTION.

The internal secretion from the point of view of general biology, J. STROHL (*Rev. Gén. Sci., 32 (1921), No. 9, pp. 262–273*).—This is a critical review, with bibliography, of recent work on the influence of the endocrine glands on body development, growth, secondary sexual characters, etc., from the standpoint of the biological processes involved.

Influencing the growth of horny tissue (hair, nails, epidermis) by specific feeding, N. ZUNTZ (*Deut. Med. Wchnschr., 46 (1920), No. 6, pp. 145, 146*).—The author reports that the feeding of hydrolyzed keratin (proprietary preparations) increased the thickness and weight of wool in sheep and hair in men.

Digestibility of fodders, J. C. BRUNNICH and V. S. RAWSON (*Queensland Agr. Jour., 15 (1921), Nos. 5, pp. 195–198; 6, pp. 235–239*).—The authors fed four wethers during 12 feeding periods of 12 days each and determined the digestion coefficients tabulated below:

Composition and digestibility of Australian feeding stuffs.

Feed.	Composition.					Digestibility (sheep).					Starch value.
	Organic matter.	Crude protein.	Ether extract.	Crude fiber.	N-free extract.	Organic matter.	Crude protein.	Ether extract.	Crude fiber.	N-free extract	
	P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
Alfalfa h[illegible]	80.96	15.95	1.40	25.40	38.21	71.5	80.4	47.1	65.0	73 3	39 73
P[illegible]y—poor	78 21	2.95	.77	34.55	39 91	55.3	15.5	33.5	62.8	52.9	23.42
[illegible]chell grass hay	76.86	3.63	1.04	42.45	20.74	47.5	17.5	39.6	60.5	32.8	13 75
Corn and millet silage	27.90	1.44	.59	9.77	16.10	60.1	22.9	60.9	61.0	63.2	12.53
Wheat bran	84.29	14.26	4.48	9.84	55.71	73.6	80.1	59.7	37.0	79.6	18 86
Shorts (pollard)	86.40	14.70	4.26	5.31	62.13	77.3	78.9	74.1	40.5	80.2	68 12
Corn meal	85.28	8.57	3.65	2.03	71 03	81.1	50 9	84.1	55.1	81.3	71.84
Coarse dried blood	82.98	78.75	1.88	......	2.35	62 8	60 8	100.0	....	100 0	50.60
Fine blood meal	80.77	71.40	3.39	...	5 98	88 0	89.0	80.9	.. ..	75 9	68.19

Comparisons are made throughout with results obtained in Germany and in the United States. The digestibility of the crude fiber of feeds grown in Australia was found relatively high, due, it is suggested, to the rapid growth plants make in that country. The coefficients for protein and fat tend to be lower than those determined elsewhere, and in connection with the lower digestibility the proteins it is noted that Hawkesworth (E. S. R., 44, p. 268) states that t nitrogen content of Australian wool is about 2 per cent lower than that English wool.

Studies of lactic silage based on the physiology of microorganism C. GORINI (*Clin. Vet. Rass. Polizia Sanit. e Ig. [Milan], 42 (1919), No. 6, 171–185*).—The author reports that the presence of sodium chlorid in mi cultures of butyric acid and lactic acid bacteria tends to reduce the actio of the former. Low incubation temperature (30° C.) had a similar eff